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FEBRUARY 1993

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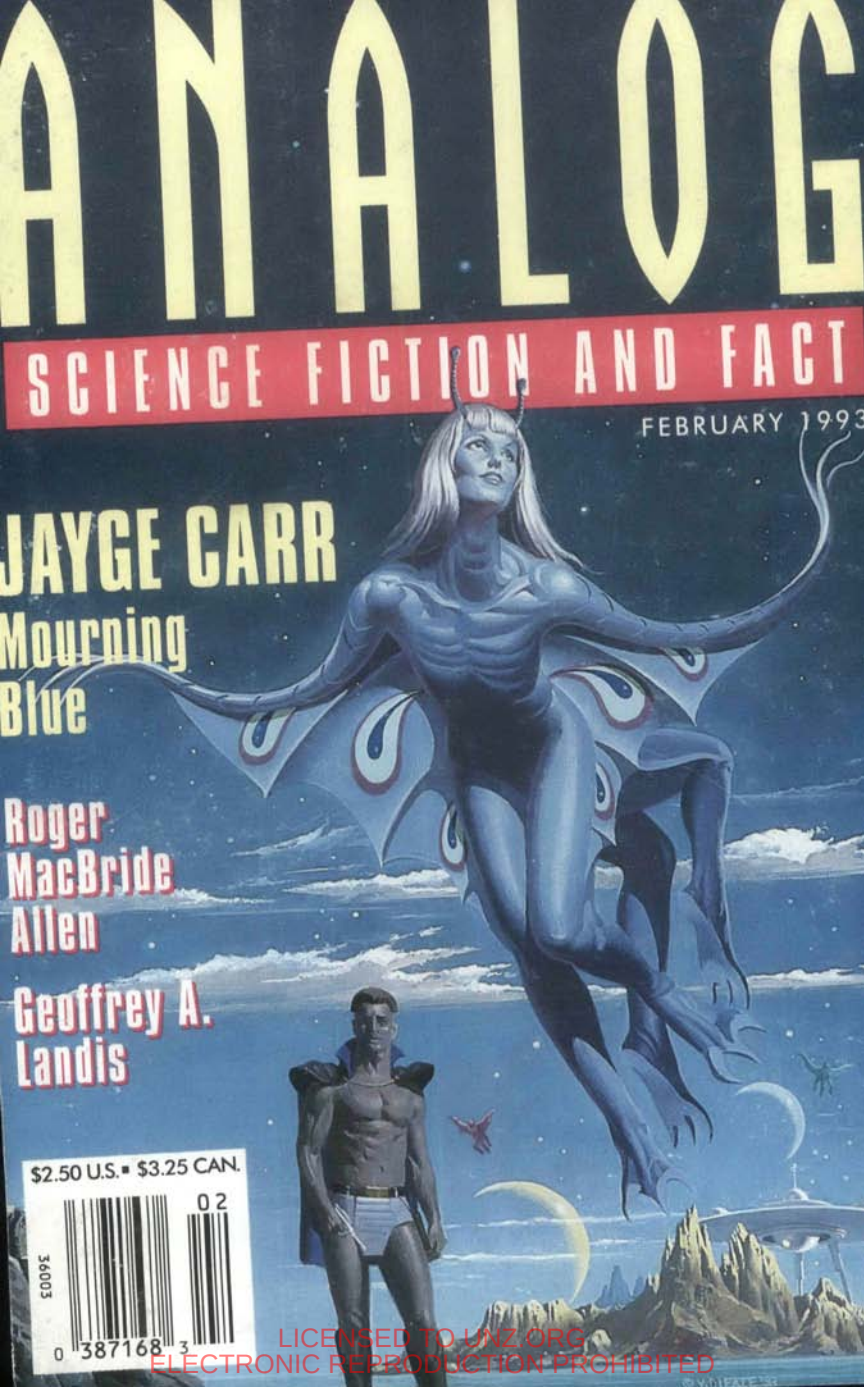

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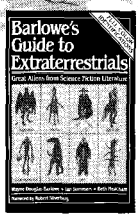

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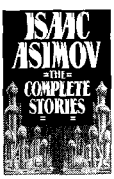

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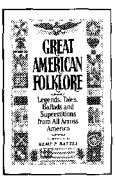

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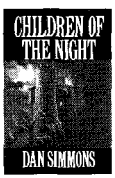

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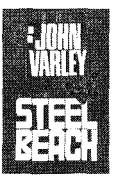

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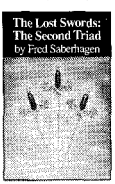

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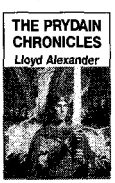

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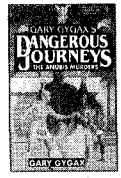

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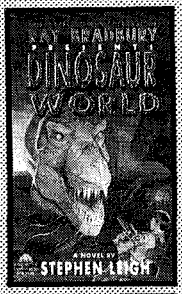

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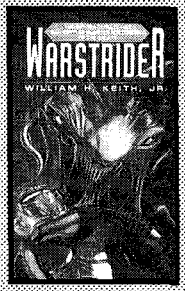

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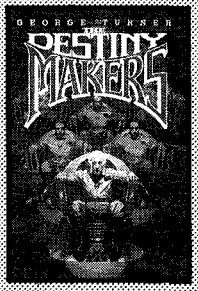

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EDITORIAL Stanley Schmidt

THE MANUSCRIPT THAT NEVER WAS

Some of the effects of any important new technology are obvious, at least after they've happened. Others are so indirect that they might never occur to anybody except the few affected, even after they're well underway.

I had one of these called to my attention when I was browsing through a recent issue of *Publishers Weekly* and came to an opinion piece by Barry R. Levin titled "Manuscript Collection—An Endangered Species." Mr. Levin is a rare book dealer specializing in science fiction, fantasy, and horror; and he recently had a horrifying experience of his own.

Among other things, Mr. Levin deals in manuscripts—the piece of paper on which an author has physically put his words, both finished and "in progress." Ideally, a collector would like a manuscript to include all stages of the work: preliminary notes, all drafts, and the final "setting-copy" that is sent to the publisher for copy-editing and typesetting. Collectors and literary scholars are interested in such things not only because other collectors pay money for them, but because they make visible the process of creation.

Or at least they used to.

In days long gone, everything was handwritten. There could be little doubt that a manuscript or note was one the author had written. Since there was no easy way to make exact copies, a manuscript that was authentic was also unique. It was an ideal situation for a collector, whose main concerns were authenticity, uniqueness, and the opportunity to see every move the author had made. It was less than ideal for writers, since handwriting a novel is a laborious process, it's difficult to make changes once words are on paper, and all the labor invested is terribly vulnerable to loss if something happens to that unique paper manuscript. For editors, the situation was tolerable only because nothing better was available. Would *you* want to spend your life trying to read other people's handwriting?

For such reasons, writers and editors were quick to embrace the typewriter when it became an option. The

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"manuscript," at least in its final form, became a "typescript," because editors now refused to read anything less. Some writers did all their writing on the typewriter; others did notes and early drafts by hand and typed the copies they sent to editors. Either way, a story or article normally evolved through several distinct drafts, each of which was likely to have corrections handwritten on it by the author. That fact made the new method tolerable to collectors, though less satisfactory than the old way because large parts of what they had to collect was machine-generated rather than handwritten. To editors it was a godsend, because it made their jobs much easier on their eyes. Authors preferred it, too, because typing is faster and less tiring than handwriting—and also because a typewriter can easily generate, with carbon paper, a second copy as insurance against the loss of the original.

About a decade ago, the typewriter also began a plunge into obsolescence, and very few professional writers still use one. "Now," as Mr. Levin writes, "with the invention of the computer and word processing, we have the dreaded printout. So we have progressed, if that's the term, from a unique handwritten document, which gives us a clear insight into the author's creative process, to a sterile, clean printout which can be produced in potentially limitless numbers and which tells us nothing about the author's creative process." Printouts, he goes on to explain, are of value only if they are demonstrably authentic working copies, identified by such means as copy-editor's marks and a letter of provenance from the author.

The horrifying experience that prompted Mr. Levin to write his *Publishers Weekly* piece (I wonder what tools he used?) came during a recent attempt to purchase a manuscript package through an author's agent —when he found that there *was* no setting-copy. The "manuscript" went to the publisher, and thence to the typesetter, only as a computer disk, with all subsequent editing done on-screen.[1] Mr. Levin describes this as "the last straw" from the standpoint of collectors, archivists, and literary scholars. "The future of manuscript collecting and literary scholarship is

[1]Please *don't* send submissions to *Analog* this way. We still prefer to do at least initial editing on paper manuscripts.

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truly in danger," he says, and goes on to suggest ways to preserve them.

Grudgingly granting that authors will probably continue using word processors, Mr. Levin urges them to make printouts at all stages of a work in progress; to make a hard copy of "the original" before making any changes onscreen; to keep, label, sign and date all notes and drafts; and to write a detailed letter of authentication, including anything they would like future scholars to know about the work. "Why let someone a hundred years from now try to tell people what the author 'really' meant," he asks, "when the author can do it himself?"

I have a certain amount of sympathy for the collectors' position (though I also seem to hear a faint chorus of annoyed authors protesting that they already said what they really meant in the work itself and would like nothing better than to be taken at their word). My own interest in other authors' notes and drafts is not to try to figure out what they really meant, but rather to see how they worked and what I might learn from their methods to apply to my own. (I've known some 300 professional writers, and have yet to meet any two who work the same way. But any writer is well advised to learn what he can about how others do things, appropriate what works for him, and discard the rest!)

When I taught a college course in science fiction, it occurred to me that there was a great gulf between two kinds of courses in which students

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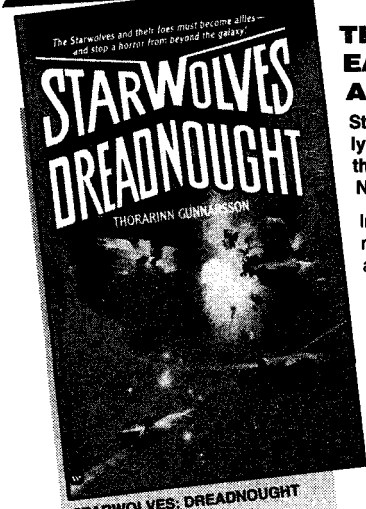
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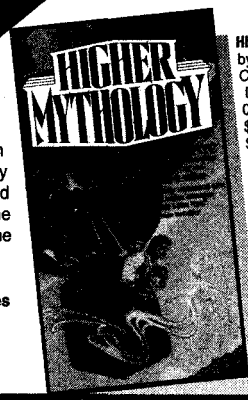

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commonly dealt with writing. On one hand there were literature courses in which they read the final form of well-established and highly regarded works, which they were tacitly encouraged to believe sprang full-blown from special minds quite unlike their own. In composition courses, on the other hand, they attempted their own writing and were often painfully aware of a great apparent distance between what they wrote and what they read.

I thought my students might find it useful to see the complete evolution of a published story, from its primitive germ to its final published form. So I showed them *everything* for a story of my own: the original two-line idea jotted in a pocket notebook; handwritten ramblings groping toward specific characters, setting, and plot; all drafts and all editorial correspondence. In other words, I gave them exactly the kind of "complete manuscript" package Mr. Levin would like scholars to have for every story—and I deliberately chose a story that gave me quite a bit of trouble.

As I suspected, seeing the complete evolution of a published story was a completely new experience for almost all the students, and most were very enthusiastic about it as a learning experience. I would like to see more students have that opportunity. Nevertheless, I suspect Mr. Levin is right that manuscript collecting as he knows it is an endangered species. Unlike him, I'm not particularly bothered by that fact. I see this endangered species as one of those extinctions that are an inevitable part of evolution.

You probably noticed, in my capsule summary of how writing methods have evolved, that the interests of writers and collectors have tended to be pretty directly opposed. The collector's favorite is the completely handwritten, completely unique manuscript; the writer sees that as tedious to produce and frighteningly vulnerable to loss or damage. Mr. Levin speaks of "the dreaded printout"; the only time a writer dreads a printout is when he's having printer problems and can't make one, or when he'd rather just send a disk. Most of the time, writers see disks and printouts as lifesavers.

Producing a final submission copy used to mean hours, days, or weeks of slaving over a hot typewriter. Now it means at most a few minutes of instructing a printer, plus a few more minutes (or hours, if the piece is very long) of staying in the general neighborhood and checking periodically to make sure things are still working right. Moreover, worrying about lost manuscripts is a thing of the past. When you're working on disks, it's a trivial matter to keep multiple backup copies, and to print out a new hard copy whenever somebody needs one. And it's far easier to make changes—even big ones—than it ever was with handwritten or typed manuscripts.

I had this point driven home to me quite dramatically when an editor returned an article that I wrote shortly after I started writing on a computer. He liked it, he said, but he'd like it

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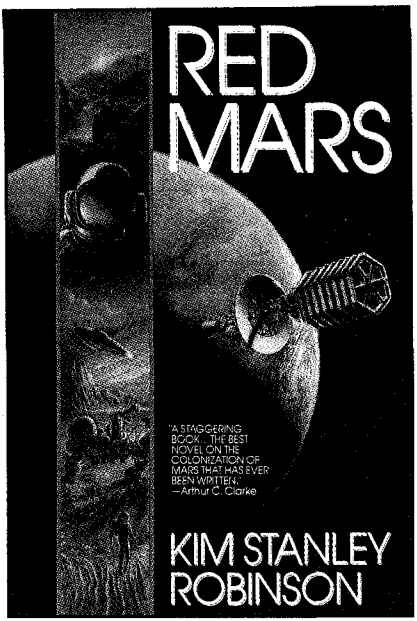
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even better if the topics were arranged in a different order. My old estimator, trained on typewriters, said that meant at least a very full half-day's work, to identify sections, move them around, rewrite transitions, and type a new manuscript. With the manuscript stored on disk and large chunks of time hard to come by, I decided to attack the revision in small stages wherever I could find a few minutes. After two ten-minute sessions, there was nothing left to do except click PRINT and go to lunch.

A writer doesn't need many experiences like that to find the prospect of doing what collectors would like very unappealing. I was a relatively late convert to writing on a computer (my agent tells me I was his second last client to make the switch), but I'm a very thorough convert. Time was when I was much closer to Mr. Levin's ideal; I wrote early drafts with ballpoint pens, and saved them all. When I heard more and more people talking about their experiences writing on computers, I was tempted by the obvious advantages, but also a bit leary, partly because of concerns similar to Mr. Levin's.

I liked, for example, the fact that when I made a handwritten correction to a handwritten or typed manuscript, the part that I had crossed out was still visible in case I later decided to go back to it. I knew that a significant amount of my final polishing happened during the typing of the setting-copy, when the lazy typist in me kept finding shorter ways to say what I'd first written. If I switched to a computer, I wondered, would I too often regret changes that were made without preserving the original? Would I lose that final polishing step if I wasn't hand-typing the setting-copy?

When I took the plunge, I quickly developed a whole new set of work habits that were quite different from the old, but served the same functions in ways better suited to the new medium. I seldom, if ever, regretted changes made on screen, because it was so easy to make new ones. If I was in doubt about which of two ways to do something, I could easily do both and make my final choice later. I no longer did any last-minute editing during final printout, but I did much more at earlier stages. It's so *easy* to make changes onscreen, without any concerns about getting the work area so cluttered that nothing is legible (as often happened on paper).

Therein lies one of the major reasons why I think Mr. Levin and his collecting colleagues have an uphill battle ahead of them. The new tools have so changed the way writers work that the things collectors want them to do would take a sizable amount of extra, and tedious, work. Most writers are more interested in being read (and paid) than in being studied. They simply don't have much interest in making scholars' lives easier *per se*. The only way they'll be persuaded to do that extra work is if they can be convinced that the manuscript market itself is financially rewarding enough to make it worthwhile. Most writers haven't found it to be, and few have much confidence that it will be in the

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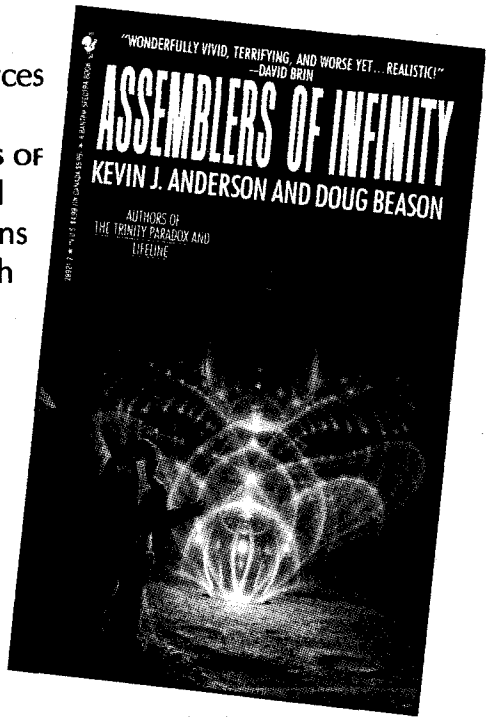
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future.

Even if they can be so persuaded, what they do won't be quite what Mr. Levin suggests. "Printouts at all stages," for example, no longer has a very clearcut meaning. Most of us who write on computers are likely to make little tweaks throughout a piece every time we sit down to work on it. Does every tweak amount to a new draft? If so, very few of us can afford all that paper to print them all out, or justify cutting down that many trees.

Personally, I do tend to make printouts from time to time, especially during the development of a big project—mainly so that (a) my wife can read what I've done and make suggestions, and (b) I'll be able to keep working even if I suffer a major power or disk failure. But I doubt that I make as many as collectors think I should, and I certainly don't preserve all versions of every little change (as I did when I crossed out and wrote in the margins). Furthermore, my notes now are frequently done in hypertext, which means they *can't* be printed out in the form I actually used.[2]

There are other areas in which handwritten notes in permanent ink still have a special value. In scientific research, for example, they're important as a means of preserving verifiably original, unfudged data. But even there, it's getting harder and harder to insist that everything be done that way. Too much data now first appears as digital printouts from automatic instruments, and scientists are no more eager than storytellers to go back to the tedious old ways.

As an undergraduate physics major, I once took a nuclear gamma ray spectrum by setting a single channel analyzer to count for a preset time in a specified energy range, writing down the result, repeating the process for dozens of other energy ranges, and drawing a graph. Why would I ever want to do that again after learning that a multichannel analyzer can scan the entire set of energy ranges many times every second, accumulate counts for as long as I like, and print out the results as either a table or a graph whenever I ask it to?

In both the literary and scientific cases, the new, computerized methods do indeed have the disadvantages Mr. Levin complains about, from the collector's or historian's point of view. But I'm afraid the collectors and historians are going to have to learn to live with those disadvantages, or else find innovative substitutes for the old ways that serve their needs without interfering with those of authors or scientists. From the writer's or scientist's point of view, the main consideration is to get their own job done, and the things most important to collectors are among their lower priorities. For them, the advantages of the new ways are simply too great to give up. ■

[2]As described in *Writer's Digest* for February 1990, and in an updated version in the *SFWA Bulletin*, 1992.

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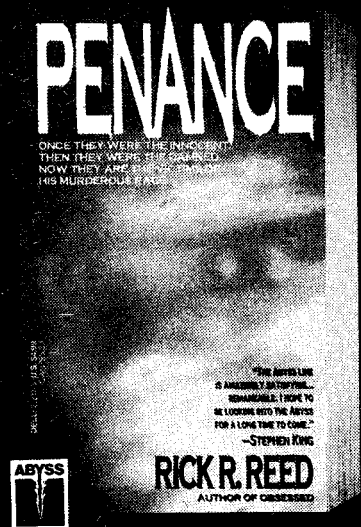
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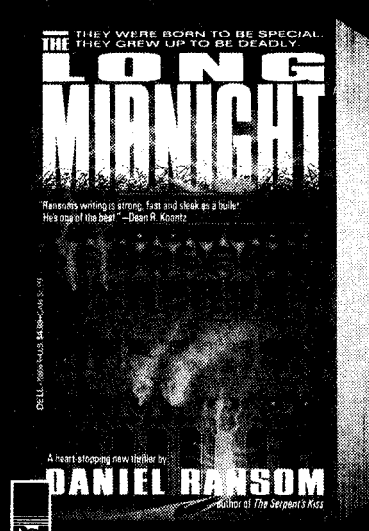
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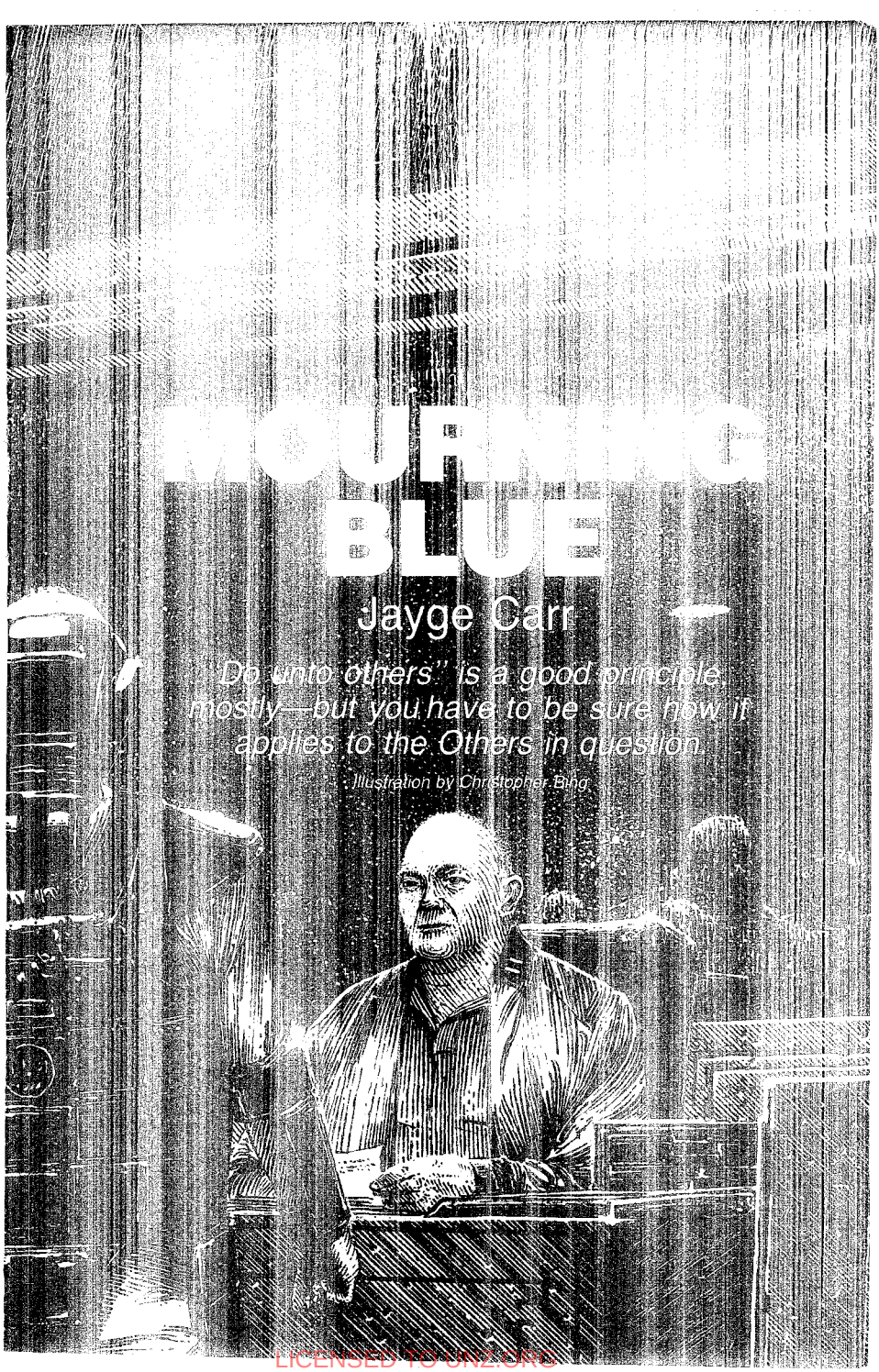
MOURNING BLUE

Jayge Carr

"Do unto others" is a good principle, mostly—but you have to be sure how it applies to the Others in question.

Illustration by Christopher Bing



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Different? Of course it was different back then! But you wouldn't know the meaning of the word. Why, I could tell you such tales. . . .

The rest of the spaceship's crew knew better than to interfere in a fight involving Abednego Jones. They just waited patiently, silently, out of range of the devastation, until Jones turned away, wiping his hands absentmindedly on his shorts, and lumbered out. Then they could drag the two unconscious bodies to the sick bay for patching up.

"Jones," the Captain asked with a sigh, "did you throw the first punch?"

"Yes, sir." There were a dozen witnesses; but on previous occasions, Jones had as readily admitted his guilt when there had been no witnesses at all.

"Jones . . ." But the huge Crewman Jones continued to stand at rough attention, eyes focused above the Captain's head. The Captain sighed again, drumming his fingers restlessly on his console. Then, coaxingly: "Haven't you *anything* to say for yourself, Crewman Jones?"

"They aren't dead, sir."

They could have been. The over two hundred kilos of solid bone and muscle that was Abednego Jones didn't *quite* dent the metal floor.

The Captain had been through all this before, with Jones. Gently he asked, "Haven't you any defense? Was there no provocation, Jones?"

Faces turned away, an imperceptible closing of the ranks, whispers, accidents that weren't accidents, "good-humored" joshing that wasn't, sly sneers. . . .

"No, sir." He made it clearer: "No provocation, Captain."

The third sigh was defeat. "All right, Jones. I'm fining you the equivalent of both men's pay until they get out of sick bay. And the incident will have to go on your record." It was a light punishment, the mildest the Captain could choose.

"Yes, sir."

Silence, while the fingers drummed on the console. Until: "Dismissed, Jones."

"Yes, sir." Jones turned, with the massive slowness of a boulder tipping.

"Jones!"

"Sir?"

"Jones, if you ever do have any complaints . . ."

The Captain was gaudy; he had been permanently depilated, and every exposed bit of skin or whatever, including inside his mouth and his eyes, whites and all, had been tattooed with an abstract swirl of rainbow brilliance. The Captain was gaudy—but the Captain was T-norm. Jones wasn't.

"Yes, Captain. I'll report to you immediately, Captain." But they both knew he wouldn't.

Oh, Abednego Jones was real enough. Most of what people say about him is myth, legend, but there was such a man. He lived, breathed, crewed on real spaceships. . . . And around the core of his reality the legend grew, like nacre around grit to make a pearl. But that was later, when he did the things that made him famous, that made him Abednego Jones. *But* why *he did those things, why he became Abednego Jones, Legend—that came earlier, when he was just another space-*

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joe—almost.

Trouble is, you just can't imagine—I say prejudice, bigotry, xenophobia, they're all words to you. Thanks in part to Abednego Jones, the legend.

All right, all right, you can try.

*Imagine how it was before humankind met the Ciumpiichn, or the !Kiir*twl, or any of the other space-traveling races; when the human Universe was an overcrowded Earth and a few dozen straggly, struggling colonies.*

Imagine life lived teetering on a narrow wire over a flame-filled abyss.

Imagine fear, hatred, and constant, constant danger.

Anything new can be dangerous, deadly. Anything different. . . .

Now put in the middle of that picture Abednego Jones, from one of the earliest colonies. A heavy planet adaptation, like a boulder carved by a lazy sculptor with the fewest possible strokes, two hundred kilos, more, of solid bone and muscle.

Like those primates a couple of systems over, the big ones, eyes squashed down into their chins, no necks, a meter across their shoulders and as thick as they're wide. Yeah, them, the ones the thinkdocs are watching so close, 'cause they seem ready to break into sentience. They look like your old-style heavy planet adap, before they learned to make more efficient bone and muscle instead of just bigger. You rarely see it these days, because the older ones have had themselves biosculpted to match the kids—fashionable, you see. But that all came much, much later than the time I'm talking about.

Trouble is, you don't understand ugly any more than you understand different.

But try to picture ol' Abednego: a mountain walking, he shook the earth as he passed, his very size made more normal folk flinch away. Menacing, unhuman, primeval . . . ugly; fight-scarred, ears crumpled, nose splotched almost flat, and his face all gouged and misshapen.

And like all the spacers on those old STL ships, where the relativisitic L-F contraction applied, time ran slow for him so to speak. The longer he was in space, the more out of touch, out of step he—and his shipmates—became.

But they had each other, the camaraderie of one's own kind. He didn't.

Then they landed on a world the human colonists called Beach. . . .

Abednego Jones was walking in the sand. That was all he'd seen so far on Beach, sand and water, water and sand. Even the "spaceport" was a platform erected over sunken pylons, with a single long freightway extension that sailed out over the water until it fetched up on a beach above the high tide mark.

He was walking a little slower than his usual methodical tread because his boots sank into the sand, and he had to pull them free at each step with a sucking slu-uu-uurp.

He wore weapons, though the colonists had told the crew the natives were harmless.

He stood on a little ridge fringed with a reedlike plant and looked down into a sheltered cove. No one had mentioned how beautiful the natives were.

They frolicked on the beach and in the waves like so many giant butterflies blown about on the wind. They were colored like jewels, like broken bits of

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rainbow, like the purest and truest colors of the Creator's palette. And the sound of their laughter was the clearest and softest of wind chimes.

Not that they were angels on the sand, no, not by any means.

Abednego Jones chuckled as he watched a sly golden native sneak away a treat two larger natives were squabbling over. The golden one ran, laughing, stuffing his stolen goodie into his mouth as he skimmed over the sand, chased by his two furious elders. All three disappeared into the water with identical silken splashes.

Abednego Jones settled himself into a convenient little hollow, well-screened by the pseudo-reeds, and chuckling, continued to watch the show being put on.

Almost, though they weren't human, weren't even close to human, he thought he could assign human motives, human emotions, to their actions.

The two in a cozy little niche watching a swarm of babies, all the while patiently picking blue meat out of intricately curled shells. Two matrons, discussing their children's accomplishments and faults.

The emerald green one, regally seated on a pile of rocks, accepting offerings constantly being brought. The patriarch, no doubt.

And that couple who ran out into the water, hand (fin? tentacle? limb?) in whatever . . . well, he hoped, for their sakes, their parents approved.

The sun had gone down in that spectacular glory you see on some worlds, but there was still plenty of light.

He thought they would soon settle down for the night, but if anything, they seemed to be more and more active. Several who had lain curled in hollows in the sand straightened out, sat up and flowed to their feet, for all the world like men stretching and yawning and stumbling awake.

He began to see individual differences, besides the obvious ones of size and color. But it took him a while to realize that the natives were two-faced. Like back-to-back Siamese twins, he decided, joined from crest of head to hips. (Heavy planet gravity increases birth abnormalities; if they were viable, they were allowed to live as best they could; there wasn't the technology to try to separate. In his youth he had seen and known many of those human unfortunates.)

He wondered if one brain controlled both "halves" or if there were separate brains for the separate pieces; front and back, instead of left and right for humans.

Then his ears were split by an all too human-sounding scream.

He sprang to his feet; it was obvious where the cry had come from. Not a hundred meters away, a blue body wrapped in what looked like silver rope foamed out of the water and was dragged back under. He ran down the slope, as the struggle continued, spewing up water and flailing limbs in a tiny circle.

The rest of the natives, adding their own screams to the din, were piling out of the water as fast as limbs and fins could propel them.

As soon as the water reached his knees, he flung his hands over his head, and propelled himself in, a magnificent bellyflop that cracked like the grand-

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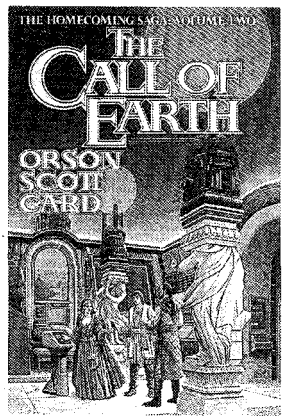

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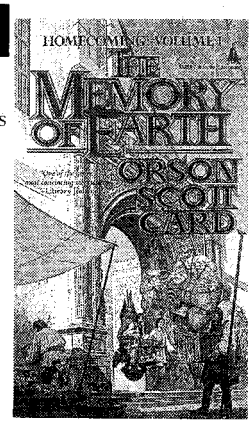

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daddy of all thunder claps, and threw up a wave of water bigger than the primary struggle.

His momentum carried him farther into the water, and then the laws of nature took over: he began to sink. Unlike T-norms he was denser than water, and he had never learned how to swim.

His own fury and frenzy carried him farther from shore, but he didn't know how to stay on the surface; he wasn't even sure, unless he was scraping the bottom, where the surface was. Even when he knew, his progress toward it was erratic. Twice he managed to break out of the water, and suck precious air into his screaming lungs. His eyes burned, the water glimmered. He was mere meters from the shore—but in which direction? He hadn't expected the sand to shelve so fast, hadn't known what an undertow was, or how far out it could drag him in a few seconds.

He had muscle, but he didn't know how to use it, didn't know how to save himself.

He was helpless, he was drowning—and he knew it.

He felt something brush by him, and he grabbed at it, with all the desperation of a man dying painfully. But it slipped away, and he wept in fury and frustration, his tears drowning in the brine.

He fought, with this strange enemy that accepted him and tormented him—until he exhausted even his seemingly infinite vitality. . . .

He regained consciousness in the shallows, with water lapping around him, but his head held faithfully out of water by the blue native. For a while, he simply *breathed*, gratefully, sucking in great salt-tanged gusts of air, eyes and lungs alike aflame, scraped skin smarting from the salt water.

Presently he realized that the trembling was not just his, but the native's; that holding even that fraction of his weight out of the water was a strain—and he managed, with a curse at his own weakness, to sit himself up.

The native shot away and eeled around him in the water that frothed around his chest as he sat, never coming quite within reach and never going more than a few meters away.

Jones had a fair eye for color; he recognized that soft shade of just-after-dawn-fades blue. "So I rescued you after all, did I?" he chuckled, and the native zoomed away, blue body cutting through green-brown water faster than a man could run. "Hey, come back!" he shouted, which only added a few meters per second to the native's escape velocity.

With a slyness he hadn't known he possessed he fell back into the water, with a great splashing and thrashing, and lay full length on the pebble pocked underwater sand.

It worked. Just as he was about to give up and scramble back to a sitting position, he felt a swish about him, and his head was laboriously borne surfaceward.

This time he was smarter. When he had to talk, he whispered, "I guess we're even at that, pretty one. I scared off whatever was trying for your smooth blue hide, and you hauled me out. Thanks. Thank you. Thank you very much."

The native trilled at him. There were no words, but the melody was very complex. He pursed his lips thought-

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fully. There was a world called New Helvetia he had visited, a mountainous world with thinly scattered homesteads. The colonists there had a sort of whistle language, a code that could pass messages from peak to peak. Around the spaceport, in the evenings, you could hear a fairy chorus of whistled messages echoing fainter and fainter. Those whistle messages, and the native's trill . . .

He tightened his lips further (with difficulty, the salt had dried them) and tried to imitate the native's song. The native fell over backwards, chiming laughter drowned in bubbles.

"Hey—" He stuck his head under to look for the native, and promptly choked. "Hey!" he spat and sputtered, scrambling to his feet and swaying like a tree ready for the final felling stroke.

The native trilled derisively and shot upright, still laughing.

Jones laughed, too. "Accent pretty bad, eh?" he choked. "Well, give me time, give me time." He pointed a wavering hand shoreward. "Whaddya say, Tweets, we go get out of this damn unbreathable stuff and onto that firma terra?" For good measure, he repeated the whistle, as well as he could.

The native trilled again.

"(Whistle) to you too, Tweets. I'm gonna get outta this stuff before I get too tired to hold my head above water." He turned and stumbled toward the shore, with the native's help managing an almost rapid controlled stagger. He didn't understand why the native urged him from the wet sand to the dry sand, but he obediently crawled the last few extra meters, collapsing on the dry warm softness with a grateful sigh.

"(Tweet, tweeti-tweet, *tweet*)," the native trilled.

"(Tweet, tweeti-tweet, *tweet*) to you, too, Tweets," he mumbled. "Wake me in about half a watch." Cradling his head in his hands, he succumbed to the exhaustion.

The native was kneeling in a graceful, four legs bent, pose near him when he awoke. He yawned, stretched, and tried to echo the native's trilled greeting as best he could. With a trembling (it was a trifurcate tentacle; he thought of it as a hand) "hand" the native offered him a rather slimy, shapeless coral-colored mass.

He was meant to take it, so he did, and held it, wondering what came next. With a trill, the blue limb urged his coral-filled hand toward his mouth.

"I'm to eat it?"

(Trill.)

"No way, Tweets!"

(Tweet-*Tweet!*)

"Uh-uh." He shook his massive head. "It'll probably poison me six ways from Sunday. Tell you what though . . ." He returned the coral whatever-it-was to the blue limb, and urged the blue limb towards the darker-blue rimmed mouth. "*You* enjoy it, Tweets." The native made one final attempt, trilling, to return the treat, but he kept pushing, and the native ate the coral whatever, delicately, but with obvious, gaily trilling enjoyment.

It was his first chance to inspect a native up close, and he was a little shocked to see no recognizable primary or secondary sexual characteristics. Possibly everything important was tucked under the legs, he thought, or under the folds of fins or whatever that

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membrane was that stretched from upper to lower limbs on each side. He realized that he was thinking of the native as a "her" anyway, had been thinking of her as "her" all along, possibly from some primitive instinct that equated little-graceful-needing-protection with female. It had to be instinct; the women of his own planet, imprinted on him as the ultimate female, were as gorilloid as he was himself. But *she* was female—and young.

"Little girl," he said softly, "little girl, where do you think your family ran off to? Are you a little girl lost, as well as a little girl blue?"

I told you this wasn't that kind of love story; if you want to hear what really happened, quit interrupting.

Look, I know what it's like now; but I know what it was like then, too. I was a spacer myself; I was there.

Relationships? That implies equality, and there was no equality, then. T-norms were the tops, then the less exotic adaps, then the hugely changed adaps, like the HPs. The natives? They were nowhere, animals.

Presentient? That's what I've been trying to tell you. All nonhumans were considered animals, whether or not they were sentient. Adaps, they were borderline; half-animals, maybe.

And having anything to do with animals was perversion, bestiality.

Oh, maybe a little rape here and there, if a female was close enough to human where it counted to be rapable, and the man was drunk or on a toot or just didn't care, and didn't mind the contempt of his mates.

But the kinder emotions: love, affection, respect, friendship—they were reserved for your own kind, and only your own kind. And the lines were carefully, fanatically drawn.

I know, what with biosculpting, and geneAltering and crossing and synthicos and humans with alien features and aliens with human features, nobody can tell nowadays. Are you human yourself? Don't tell me, I don't care. It doesn't matter now, anyway.

But it did then. And it wouldn't be the way it is now, if it hadn't been the way it was—then.

Only a desperate man would have anything to do with animals.

'Course, a man could get mighty desperate, in space. Before . . .

The Captain was jubilant, humming happily beneath his breath. It looked like they'd at last be able to leave this jinxed planet, in just a few watches. He'd begun to fear they'd remain stranded on this world of endless water and sand until his tattoos faded to dull white. But now, if only nothing else went wrong. . . . He surreptitiously rubbed the round grinning idol perched on the corner of his console. But he was sure they were safe; everything that could go wrong already had. . . .

An attitude like that is begging the forces of chaos and improbability to intervene; so of course, they did.

"One of the crew wants to be paid off *here*." The Captain yawned and stretched and tried to work the kinks out of his shoulders. "The man's insane. I doubt this colony'll last until the next ship lands."

"It won't matter to *him*." The first mate made a spitting sound. "He's gone

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native." Standing, his eyes were level with the Captain's, seated. He was a purebred Bushman, golden-brown of skin, hair growing naturally in little tufts over his scalp. His ancestors had almost been wiped out by their neighbors, enslaved, or forced into the inhospitable Kalahari desert. They had been rescued on the brink of extinction by a UN commission, given their own land, "civilized." But they had kept their memories. The first mate was the most rabid xenophobe on board.

The Captain shrugged. "Most of the men have. What do you expect, when we're planet-bound as long as this."

"Not with the colonists," the First Mate elaborated. "*Native* native. With those slimy *things* that live on the beaches."

"I doubt he's the only one." The Captain shrugged again. "With a colony this small, there's not enough spare women to go 'round. Better the natives than having the colonists ready to form a lynching party." He grinned. "Besides, there's several of the crew I'd be just as glad to see the last of, if you know what I mean."

"Oh, I do, sir, and this man is certainly one of them." He ran his finger inside his collar to ease it; he was never seen in less then full dress uniform, pristinely clean and crisp, the creases ruler-straight and scalpel-sharp. "It just riles me to see a man, even a quasi-man, an adap, demeaning himself with *them*."

There's none so fanatic as the recent convert, the Captain thought of his Mate, not for the first time. But it's ridiculous to carry that attitude down through all these generations. . . . Then one of the last things the Mate had said filtered through. "Which adap?" the Captain snapped.

"The big one," the Mate gloated. "The mass-eater. Jones."

"Ahriman take him," the Captain snarled. He shot out of his seat, zoomed round the console, and was out the door before the Mate had time to blink.

"But, but, sir," the Mate stuttered, as his short legs churned to keep up. "He's only an AB, a dial-watcher, one of the engine gang. We can replace him at the next port—sir?"

The Captain stopped, and the Mate caromed into him. Only the Captain's quick reflexes kept the slighter man from falling down. "We're not going to replace Jones," the Captain said, gently, "because he's coming with us. Except for you, me, and the medic, I'd leave any other crew member before I'd leave Jones."

"But—but—but—" Though he was standing still and looking up at his superior officer, the Mate somehow seemed to be jumping up and down in a royal rage. "He masses more than any other three crew members." He ticked the points off on his fingers. "He's only an AB. And he gets in more trouble, and is responsible for more fights, than the whole rest of the crew put together. You should welcome an excuse to get rid of him."

The Captain shook his head. "No, Jones stays. For all that size of his, he masses less than the heavy duty mech I'd need to replace his strength. A mech can't think, and he can; a mech can't stand watches, and he can. But that's not why I'm determined not to let him go. Haven't you noticed, for all the

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other men despise him, he's the one they invariably call in to solve a mechanical difficulty? He's a genius with machines. He's served under me since I was ensign on that flaming bucket of bolts, *The African Queen*. And several times he's been able to pull a ship through, when everybody else was ready to throw up their hands and die quietly. I think—'' He spoke aloud an opinion he had long held privately. ''It's *because* the other men despise him. All the understanding and empathy and—and everything a man should share with his fellows, Jones channels into his machines. Or maybe it's instinct, or early training in survival, or sheer good luck. I don't know, and I don't care. It doesn't matter. Jones stays. Now—'' very gently—''where is he?''

''On the *beach*,'' the Mate's mouth was as pursed as though he was sucking lemons. ''With his native *peers*.'' He spat again, but not until the Captain was too far away to be able to hear the little liquid splat.

Jones was exactly where the Mate said he was, but the Captain almost missed him. He was well out into the water, bent over, only his head and shoulders visible above the frothing waves.

The Captain paused on his little crest of sand and frowned. What in the name of the Seven Heavens was the man *doing?*

Most of the natives had gathered on shore, watching, whistling excitedly, but several were in the water, circling Jones, their bodies cutting jeweled swathes in the dark water.

Whatever Jones was doing, it was difficult even for his strength. But gradually, centimeter by centimeter almost, he was drawing shoreward. As he reached the shallower water, the Captain could see what was happening. He was pulling a net, a large, loaded seine.

Food for his new friends, the Captain thought, and sure enough, when Jones reached the shallows, he and some of the natives opened the seine, and the whole mob dived in, with much the air of starved picnickers attacking a well-loaded basket.

The Captain didn't share the prejudices of his fellows. The colonists might dismiss the natives as ''eels with four legs'' but the Captain appreciated their brilliant coloring against the sand and sea, their graceful movements, and the sweet music of the sound they made.

Like Jones before him, the Captain was content to stand quietly in the shadows of the pseudo-reeds and watch, unaware that he was wearing a fatuous smile.

Two of the smaller ones skimmed up to Jones, and there was a brief conversation. Then the man's shoulders shrugged—the Captain could almost imagine he heard the massive sigh—and the man reached down and took four tiny tentacle clusters in each brawny paw. Then he began to rotate, slowly at first and then faster and faster. The youngsters trilled, as the centripetal force swung them higher and higher, until their bodies were spinning parallel with the beach.

''Whee!'' thought the Captain, broadly grinning at the human merry-go-round and its excited passengers.

The passengers' cries didn't go unno-

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ticed on the beach, either. Despite the smorgasbord in the loaded net, at least a dozen of the smaller natives came dashing up, vociferously demanding their own turns. At some signal the Captain couldn't detect—Jones had whistled his version of, "All right, all right!" but the Captain couldn't distinguish Jones's whistle from the others—the youngsters lined up in two neat rows to wait their own turns.

There wasn't even any of the pushing and shoving and arguing that you'd expect from a similar crowd of human youngsters.

The Captain frowned, reviewing what little he'd learned from the colonists about the "natives." The colonists couldn't agree on the definition, most tended to dismiss the beach-dwellers as just animals. No tools, no clothes, no technology, no social structure beyond family groupings—which formed and reformed casually, according to the colonists. No natives successfully trained as servants, or taught to speak Common. No sex or sexual differentiation until fully grown; sexuality developed in the final stage of puberty. No territorial instincts, so when the colonists appeared, the natives had withdrawn.

Probably saved their colorful hides doing it, the Captain decided. He had seen too many worlds where the colonists had pushed, and the natives pushed back, until there was a blood-bath. Sometimes the colonists, with their superior technology, won; sometimes the natives overran their would-be conquerors by sheer force of numbers. Either way, it was tragic.

Whatever happened here, whether these were really natives or merely very intelligent animals, he wasn't going to leave Jones caught in the middle.

He waited until all the youngsters had had their turn on the "Terry-go-round" before he stepped into the bright dusk and hailed Jones.

Jones turned at the human voice, and the Captain could see something—happiness?—snuffed out inside him. At first it looked as though Jones was going to cut and run, but he must have realized the futility of that—on hard ground, any other crew member could run rings around him; and the sand was that much the worse for him—so he waited stolidly for the Captain to slide down the dune toward him.

The Captain was panting slightly (too much console work!) as he slogged through the shifting sands toward his recalcitrant crew member.

"It won't do you no good, Captain," Jones burst out. "I made up my mind. I wantta stay here, and I'm gonna, and you can't stop me."

The Captain was not above guile. As Jones stopped speaking, he reached up and wiped his sweating forehead, swaying slightly. "Can we talk someplace out of the sun?" He allowed his voice to quaver just the slightest bit. "I didn't realize it was such a long walk, in this heat." He was as tough as biphase composite in truth; and a hoverer borrowed from the colonists, staffed by a spacer now waiting stolidly for his Captain's comm, had saved him from 90 percent of the walk.

Jones instinctively held out a supporting arm, "Follow me, Captain!" The Captain leaned heavily on it, gasping slightly as though he was having difficulty breathing.

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But he honestly felt dizzy inside the cave Jones led him to, from the concentrated stench within that made his throat close. "Whoosh," he gasped, and sank onto a convenient rock. A mixture of rot and fish and sheer alien, overripe man-sweat, a chemical tang, and sea salt so strong he kept rubbing at his eyes.

Jones looked around and shrugged. "Hard to keep the place clean," he said. "They're—careless."

The Captain's eyes adjusted to the lack of light, and he shuddered trying to control his heaving stomach. So this was Jones's new happy home. A piece of thick foamed synthi and a blanket in one corner, liberally bedaubed with bits of shell, smears of damp sand, and other stains he preferred not to try to identify. A couple of floater shelves, pitiably underloaded. A second seine, half completed, spread out against a slimy wall. Everywhere underfoot, bits and pieces and *chunks*. And in and out, in and out, piping Janus-faced aliens, their jeweled colors dimmed in the phosphorescent cave glow.

There was a projecting bench of rock, its top surface smooth with the shiny glazed smoothness of a fusion blast. The rock had run, frozen rivulets had been partially chopped off, so that what was left was a natural throne-majestic chair. Jones sat easily, in his accustomed place, after handing the Captain what looked like a hollow shell of some sort (with dark bits still clinging in the crevices) filled with . . . water?

"Salt water, Captain, to replace what you lost sweatin'. But if you'd prefer clear, I got a little, caught some rain water."

Hoping all his immos would protect him, the Captain heroically downed the greenish, bitter fluid. (Ahriman only knew what the man had caught his rainwater in!)

As soon as he had sat down, several of the smaller natives scurried to fill Jones's capacious lap. Instinctively, his arms had gone around to hold his charges safe, a Mount Rushmore-giant Santa with a pack of dimmed-rainbow younglings.

The Captain eyed Jones over the bowl; after his first few hearty gulps of (Ahriman-taste) water, he had slowed to cautious sipping, interspersed with remarks such as, "That terrible heat. I wonder what it's like in high summer here?" He was searching for a handle to get back his crew member. It was obvious that Jones had gotten himself well and truly adopted by this particular group of natives. It was also obvious that he was wallowing in this acceptance, in his new role of protector/defender/giant demigod.

The Captain had noted before, with some amusement and a quiet satisfaction, that to aliens, Jones was just another member of those strangers, the humans. If they accepted humans, they accepted Jones. But the relationships had always been . . . shore-leave affairs. This was another order of magnitude. This was dangerous.

He found the one argument he thought might work.

"Jones," he said quietly, "how are you going to feel when some disaster you can't handle overtakes these people? If a human bug mutates, or the colonists do something that ruins their feeding ground, or a hurricane, or tsu-

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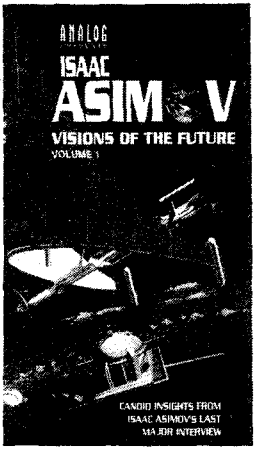

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nami, or just the colonists deciding they want this area, and cleaning out the natives the easiest and quickest way?''

The argument backfired. Jones tightened his arms around the younglings wriggling in his lap, and thrust his steep cliff of a jaw out. ''But you don't see, Captain? That's when they'd need me the *most*.''

The Captain started to ask what Jones thought he would do *after*, and stopped. It was obvious, that for Jones, there would be no *after*. He nodded, slowly. He hadn't gotten to be Captain by continuing to beat his head on an impervious wall, once he *knew* it was impervious. ''All right, Jones,'' he said. ''I just came for old time's sake, because I wanted to be sure you knew what you were doing, understood what the consequences might be, were firm in your feelings. Well—'' He rose, extended his hand. ''I'm satisfied, Jones. This is your choice, and I can't do anything but respect it. I've appreciated your loyal service, and I wish you the best of luck in your new future.''

Jones cleared his lap carefully, rose, took the Captain's hand, tears dribbling down his cheeks. ''Captain—thank you, Captain. I knew you'd understand.''

The two men shook hands vigorously, the Captain wondering if he'd get back a hand, or a shapeless crushed mass.

The Captain extricated himself from Jones's rather watery gratitude as quickly and as tactfully as possible. But at the dusk light glowing at the opening of the cave he snapped his fingers and turned. ''Jones, I just thought. The colonists won't care for what you're doing, they may not honor your credit. Why don't I give you the equivalent of your credit due from the spare stores? The Supercargo and I could pick out a real good selection, it'd be worth more to you than the credit.'' He winked, to let the man know that, with the Captain overseeing the picking, there would be plenty of odd items not showing up on an inventory included.

''Thank you, sir.'' He put one arm around a blue native, who cuddled up against him like a trusting puppy. ''For all of us—thank you!''

The Captain nodded, shielding his eyes against the setting sun's brightness. ''You've earned it, man. I only want to see you get what you deserve.'' He pulled his lower lip, considering. ''We won't be leaving for several days. I'll get the Super on it right away, we can use one of the cargo shuttles—tush, don't thank me, man!—to haul it. Hmmm . . . day or two, maybe three. You'll be expecting us—well, I'll be busy then, probably, so close to liftoff. But someone'll come.'' He was thinking that one of the privileges of rank was that you didn't have to watch the betrayals you ordered.

The shuttle came three local days later. Jones had cleared off a bit of higher, rocky area he thought would be able to take the weight of the shuttle, and then drawn a *big* arrow in the sand above the waterline pointing to it. (He had learned about the tides.)

The shuttle landed clumsily, as though it were overloaded or someone out of practice was piloting. At the explosive crunch of the landing, all the natives dived for the safety of the water.

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TECHNOLOGY UPDATE

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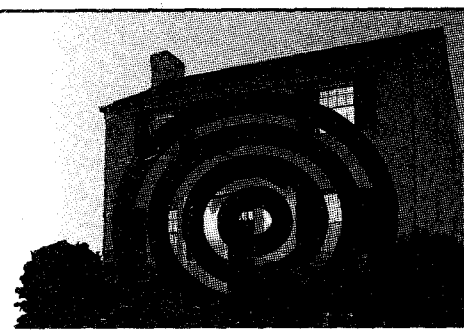

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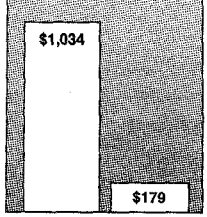

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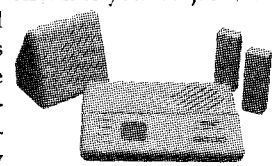

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Jones, shrugging, scrambled up the rock and sand rise.

The shuttle port creaked open, and the ramp grounded with a rattly crunch-clang. Voices grumbled within, and then a crewman staggered out under the load of an outsize crate. "Your stuff," he panted. "Ain't you gonna lend a hand?"

Jones trotted up the ramp.

They were waiting for him inside. Two stun rays hissed, and he fell, the beanstalk giant brought to Earth at last.

"We got 'm," someone sang out, and the man with the crate, cursing, heaved his burden back up the ramp.

Jones stared up at the four faces bending over him, the First Mate, and the three largest, strongest men in the crew besides himself. "You know what we oughtta do with him," growled one of the men, a brawny Terran with boldly carved Amerind features allied with skin and hair of Nordic fairness.

"Shaddup," the Mate said. "Put him away."

Two of the men shoved a pile of small crates aside, and if Jones could have cursed, he would have. Neatly seamed onto the cargo hold deck was his own special outsize acceleration pod. Loaded, no doubt, with nutrients and enough drugs to keep him dormant until they were close enough to light speed that he couldn't come back. Not until after the ship slowed down again, fifty or a hundred relative years later.

They wouldn't even have to unload him. Just leave the pod in the shuttle after the shuttle was itself loaded back aboard.

The three crewmen started to drag his helpless bulk toward the pod.

"Wait a minute," the Mate ordered. He was standing in the open bay, gazing out at the beach and sea below, thoughtfully smoothing an already perfect crease. "Bring him back here and seat him on this crate. Wedge something behind him to hold him upright."

"Sir?" the Vikindian said.

"Sir—he's heavy," one of the others complained.

"Do as I say!"

Grumbling under their breaths, they obeyed.

A few of the bolder natives had crept out of the sea and were gazing up at the shuttle. At the sight of Jones, a tremendous twittering arose.

Jones was completely helpless from the stun, only his autonomic systems continued to function.

"Sir," the Vikindian pointed out, "we can't onload the ramp with him sitting there. And we ought to be heading back."

"Well, no, not really," the Mate said thoughtfully. "You see, we had a little trouble finding this place, didn't we? Cruised around a bit, used up some extra fuel doing it. Used at least an hour's worth of fuel at cruising speed, didn't we? So—we needn't hurry back, for at least another hour."

"Sir?" It was a puzzled chorus.

"I wonder what would happen," the Mate mused, "if we took the shuttle around this cove, high speed, low level, ten or twelve times."

"Sir," the youngest of the three burst out, "the heat from the exhaust—those natives! The ones on the beach'd fry, and the ones in the water'd boil!"

"Yes," the Mate nodded. "I rather think that might be the result. But of

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course, we used that extra fuel, cruising, trying to locate our missing Crewman Jones, right, men?''

''Right, sir,'' it was a reluctant chorus.

''Say, sir,'' the Vikindian said with a grin. (He had been on the receiving end of Jones's fists more than once.) ''Long as we're going to have us some sport, shooting some sitting ducks . . .'' He reached over, took Jones's flamer out of its holster, sighted up it. ''Let's adjust this thing to needle, and see who can get the highest score—out of ten shots, say.''

''Put that back.'' A thin smile. ''Start shooting at them, and they'll just scatter, out of our reach. As it is, they can see our Mr. Jones sitting here, they'll stick pretty close.''

A hissing sigh that might have been a groan, or even an attempt to whistle-talk, escaped Jones's helpless lips.

''Sir—'' The youngest man squared his shoulders. ''I don't think it's right—sir.''

''Are you talking mutiny, Shimatsu?''

''If you give me direct orders, sir, I'll obey them.'' *But I'll run tell the Captain as soon as we get back!* his stiff back said.

''You don't object to killing a few animals, do you? Why, it's a mercy killing, that's what it is. When the colonists expand into this area, they'll take all the fish, and these animals'll starve slowly. Isn't a quick easy execution better than slow painful starvation?''

''That's not what I mean, sir. It's—it's doing it in front of Jones, sir. It's wrong. It's cruel—sir.''

''Shimatsu, Mr. Jones doesn't want to come back with us. But the Captain sent us, and we're taking him back, as ordered. But it's against Mr. Jones's own wishes, right? Now isn't that wrong and cruel, too?''

''Yes, sir,'' the youngster answered. ''But it's for his own good, sir.''

''Right, son, right. And—*so is this*.''

''Sir?'' Behind the youngster, the other two were grinning and nudging each other in the ribs.

''*Why* does Mr. Jones want to stay on this world, away from his own kind? Because he has a perverted fixation on those slimy animals out there, that's why!'' His child-size hand patted the huge shoulder, which would have been trembling if it could. ''So—we're going to cure that. The only way we can. We haven't hi-tech mind facilities here. We have to use what rude, crude means we can. Do you know what some of these prim worlds have to do, if someone is hurt and bleeding to death, and they haven't a medic to cure him? They cauterize the wound, burn it closed, stop the bleeding that way. Burning may hurt like Sheol, but it's better than bleeding to death, right, Shimatsu?''

(Gulp.) ''Yes, sir. I guess so, sir.''

''Well, our Mr. Jones has a wound in his mind, and if we don't do something about it, his sanity may bleed to death, too. So—we will, Shimatsu.''

''Yes-ss, sir.''

''I'm a good executive officer, Shimatsu. A good exec knows when to take a burden off his Captain's shoulders. Now our Captain is very fond of Mr. Jones, you saw how difficult it was for him to order us here. So for his peace of mind, I'm going to take responsibility for what else has to be done, for

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Mr. Jones's own good. And I'll tell you what else a good exec knows: it's when he's asked too much of a crew member. Now, I want you to go forward into the control room, and zip yourself into one of the pods. All the way in, not just control mode. We won't need your assistance on the flight back. Dial yourself a sedative, too. What the eyes can't see, the heart can't grieve over. Right, son?"

"Yes, sir. Thank you, sir."

"L'maitre, go with him and see he's properly secured."

" 'Ss, sir."

The Mate turned to the Vikindian, after the other two had gone through the hatch into forward. "Does that lad babble in his cups?"

"I don't know, sir."

"I'll see to it that you and he have the same shore leaves for a while. If he looks ready to talk in vino veritas, Runningbear—*prevent it*." The Vikindian cocked a blond eyebrow and drew a finger across his throat. "Only as a last resort. But—prevent it."

"Yes, sir!"

"And—as for you, Mr. Jones, I was going to put you into your pod, too. I thought that if you were torn between hope that I didn't harm your pets, and fear that I did, that would be the worst. But what I told that boy—what the eyes don't see . . . I want your eyes to *see*, Mr. Jones. When they burn and scream, Mr. Jones, and *die*, Mr. Jones, you'll see it. I think we can squeeze you into a regulation pod, Mr. Jones. It'll be a tight fit, and it won't support you properly, and of course we couldn't close it, but we don't want to close it. We want you to see. I'm only sorry you couldn't be on that beach with them, but the Captain . . . but you'll see. Maybe I'll set the autocook to burn a little meat, so you'll *smell*, too. . . ." He was wearing a small multitimer magnesealed to a cuff insignia. He pulled it off and attached it to the edge of the hatch, turning Jones's head so that the timer was within his peripheral vision. "We'll be taking off at 0900, ship's time, Jones. Until then, you can watch your little pets at play; I want you to have good memories of them, too. So you just sit there—and—watch."

So Jones sat, and watched, and the Mate stood, now and again flicking a bit of invisible lint off his uniform or straightening an already straight crease, at-ease figure silhouetted against the steel-grey of the hatch rim, and watched Jones.

Only once did he break the silence. "Your skin is rather dark, Mr. Jones. And your hair curls tightly. I wonder if that means you have Bantu blood back in your ancestry somewhere. I hope it does. If you had Bantu blood, that would make things just—about—*perfect*."

As the funeral-beat-interminable seconds passed, the natives, seeing Jones seated in the strange object that had made the great noise, were reassured, and began to go about their normal activities. Many, as the sun was climbing, merely curled up in hollows in the sand to sleep through the heat of the day.

Shimatsu was sealed into his pod, oblivious to what was happening. It took the full strength of all three of the others to haul Jones into the control room, in the front of the small shuttle.

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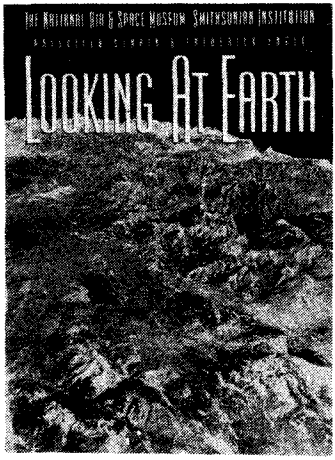

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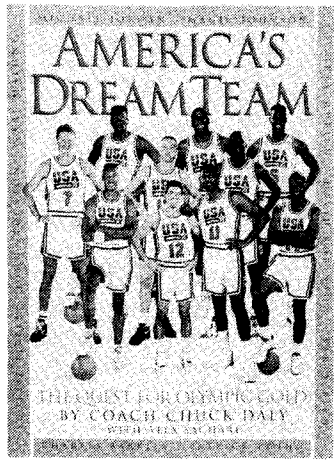

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Once there, they couldn't fit him into any of the normal-size pods.

But the Mate was determined to carry his plan through, somehow.

The Vikindian pointed out that you couldn't damage a HP with a sledgehammer, so if they padded the area between the navigator and pilot pods, and wedged Jones in—if there were any bruises, well, after all, he could have fallen down the ramp when he was stunned. . . .

"He won't be able to *see!*"

"Sure he will. Put some crates under him, raise him up a bit, and I'll tilt the nav screen so he can see. You can do that bit of piloting by the seat of your pants, can't you? You'll have your own screen, after all."

It sounded good to the Mate. As long as Jones was repairable by the Medic. . . .

He took off slowly, away from the beach and its inhabitants, and as quietly as possible, so as not to scare them into scattering. He headed away, building up the speed he'd need, telling Jones as the shuttle accelerated exactly what he intended to do.

It was a simple plan. He would head away in a big arc, building up to the top air speed of the shuttle, then shoot back over the beach, circle it in a wide ellipse five or six times to build up a barrier of impassible heat, and then spiral inward to finish the job.

Only he'd forgotten one little item.

Jones's mass. His skull was thicker, his spine buried deeper, his muscles both bigger and denser. He had been paralyzed, all right, but much of the charge had dissipated in his sheer bulk, and the stun had begun wearing off. A T-norm would have been helpless from a double stun like the one Jones received for hours; but Jones wasn't a T-norm.

The Mate had gotten the shuttle up to top air speed and was starting his turn toward the beach when Jones made his move. Concentrating his effort on the arm closest to the Mate, he heaved, reached out and up, grabbed the Mate's wrist clumsily, and tried to pull his hand back off the controls.

All he managed to do was knock the Mate's hand sideways.

But they were flying low and fast; it was enough.

They heard the crash on the beach, and within seconds the beach was deserted.

But on the little rocky outcrop where the shuttle had crashed hard enough to split open, nothing moved for a long, long time.

The Vikindian had been right, you couldn't damage an HP adap with a sledgehammer. It took a shuttle crash at top speed to do that.

But at last Jones moaned and stirred. He was one solid bruise from head to foot, burnt and half-blinded by the heat of the crash; he had a concussion, broken bones, and internal injuries.

But he was alive.

Only Shimatsu, limp in his unconsciousness and full-sealed into a pod, was likewise alive. The other three. . . .

Jones looked around, blinked—and vomited.

As the Mate had wanted, there was the smell of burnt meat. And blood. The scavengers were already gathering.

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But at last Jones's stomach was too empty for him to do more than shudder with dry heaves, and eventually even those subsided. Then he just lay, trembling but gathering his strength. Until he could crawl painfully out of the wreckage and away. In any direction, just—away.

He was a murderer, by accident but not intent, and a mutineer. But he wasn't fleeing justice. He was too hurt, too damaged for that level of thinking. He had reverted. He was a hunted animal, and a hunted animal's instinct is to run, and when it can't run any more, to hide.

Not far away, a volcano had heaved itself high, just slightly off shore, and cooled, leaving a devil's playground of ash and hardened lava, of cracks and crevices and hidey-holes. A regiment of HPs could have hidden there, and Jones did. Feverish, delirious, almost mad with pain, he lay under a dark overhang, and waited, for his body to heal itself—or death. Whichever came first.

Meanwhile, Shimatsu's sedative had worn off, but his pod hadn't come through unscathed. He pressed the controls to open—and nothing happened. He screamed to be let out—and nothing happened. A man completely sealed into an acceleration pod is almost completely helpless. Resilient surfaces surround him. He could read a few primitive gauges above his eyes, press controls, breathe, squirm a few millimeters in any direction. Shimatsu could see that something was radically wrong—and that his oxygen tank was almost empty. And when the oxy was gone. . . .

He was helpless, trapped in a broken pod, running out of air.

Trapped in a sealed coffin.

In fact the pod itself had cracked, was letting in a small amount of air, but he didn't know that.

Logically, he should have lain as quietly as possible, conserving what air he had to the maximum. But he wasn't thinking logically, he was screaming.

He was still screaming when the second shuttle, which had been sent out when the first had failed to report in and couldn't be raised by comm, landed by the conspicuous wreck.

He was still screaming when the crew of the second shuttle managed to pry open his pod.

He was not screaming while the Captain interrogated him, but only because he was doped to the eyeballs. He reported what had happened with the complete fidelity and lack of personal involvement of a sound recorder.

(Shimatsu recovered eventually, thanks to psychochemicals and other advanced techniques. But unless he drugged himself faithfully every night, his sleep was torn apart by nightmares.)

The Captain, cursing, started an intense manhunt for Jones. He was determined to have his man aboard ship before he took off—or at least his body for decent space burial.

For several days it looked like it might be burial, but Jones didn't die, and didn't die, and after a time he began, slowly, to heal. He didn't know how hard the Captain was looking for him; if he had, he would have only cowered deeper in his dried lava pseudowomb.

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Then there came a day when Jones was—not healed, not anything close to sane—but mobile.

He went back to the beach, traveling with a shambling gait that favored assorted sprains, strains, bruises, breakages, soreness, and the grating knife-pain of a couple of cracked ribs.

He didn't expect "his" people to be at the beach. He knew they migrated, had stayed longer at the beach than usual for his sake. But surely they had left some sign or hint or clue to help him to follow.

The Captain had left something. Sealed to the rock face at eye level, just outside the cave, was a message and a soss. Jones passed it by without more than a glance, not even reading the note to see who would come if he pressed the soss's button. He was running by then, because he had heard the sounds coming from inside his cave.

It was Little Girl Blue who was screaming.

His Little Girl Blue.

He skidded to a halt inside the cave mouth and gasped, and started screaming, too.

She was lying on his bed, writhing, and both she and the bed were smeared with the chartreuse fluid the natives used for blood. All six of her limbs were shapeless, shortened stubs, though most of the blood seemed to be coming from her body; it looked like someone had tried to split her lengthwise, and with fiendish cruelty had quit before finishing the job. Before finishing the job enough to kill her outright, quickly, that is.

"One-who-sinks, help me!" she trilled.

She wasn't his woman, she was physically neuter; the colonists had told him that the natives developed sex as they matured. Of course, he had had hopes that when she matured, if she developed into the right sex, if—if—if . . .

But he'd have been almost as happy to give the bride—or the groom—away. She was his child, his chosen, his darling, the center of his heart; he loved her more than he had ever loved any woman, or anyone.

Now she was mutilated, and in pain, and dying.

"*Help* me!"

So he did.

He had only his hands, and a broken-off chunk of rock, but it was enough.

After, he held her in his arms, and rocked back and forth slowly, weeping.

He was still rocking, still holding her, eyes burning because they had run out of tears to shed, when her people came back, and told him, very, very gently, what he had done.

And when he understood, really understood, he marched out of the cave like a programmed mech, and rammed his finger against the soss until the tough synthi shattered against the rock.

He was still standing there, his finger bleeding against the shards of synthi and rock, when the shuttle came and picked him up.

Xenophobia, that's hatred of what's different. But there can be a worse sin than hatred of what's different, and that's trying to treat what isn't human as though it is. The colonists saw that the natives had analogs of the human sexes, male and female, and they figured that was it—and it wasn't.

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Alternation of generations, that's what the thinkdocs call it. First generation grows up bisexual, the sexes fertilize each other, and reproduce. But the next generation reproduces asexually, fission, sporing, budding, whatever. It's their *kids who grow up sexed.*

You got it. Little Girl Blue hadn't been mutilated by anybody, except maybe her own nature, and she wasn't dying, not at all. She was fissioning. Resorbing her own limbs to make two individuals where one had been. And if she was bleeding a bit, and in pain, and frightened half to death, well, have you ever seen a human woman birthing a child naturally?

If Abednego Jones had only let her be, had only contented himself with holding her and telling her everything was going to be all right—all she needed was reassurance—there would have been two Little Girl Blues. Or rather, one Little Girl Blue and one Little Boy Blue, or individuals who would grow up to be Big Girl Blue and Big Boy Blue. That's how it worked.

If only he'd known. . . .

But reproduction is a personal thing, a private thing, among most species. He'd never seen it among the beach-dwellers before. He'd never have seen her, if they hadn't been scared so badly by the shuttle crash, if she hadn't been left in the panic, if she hadn't been alone and already half crazed with terror for him when it started. Half the kids who were near ready were triggered by their fright, analog of human adrenaline jump started the process. But she was the only one he saw, because she had instinctively crawled to where she felt safest.

You can't bring back the dead.

After? You know what happened after. A tour or two later, or maybe three, they landed right in the middle of that mess on Cassandra. That was the beginning of Abednego Jones, The Legend.

You mean what happened in the end, when he grew tired of being The Legend? What happens to any legend that outlives its usefulness? He went back to being a spacer, that was all he knew. He just went on and on, and maybe he died, or maybe he got smart and bought biosculpting, so he'd look like everybody else. Though now, what with GAing, and biosculpting, and exchanging, and the Great Mother knows what else, he'd probably be considered dully ordinary.

But he was ugly, by most standards.

Just like you're one of the loveliest fems I ever saw, and I've seen plenty.

Look, fem, just for tonight, is that frill-thing running down from your arms part of you, or artificial?

Yeah? Well, can you change its color? Turn it a pretty blue, a nice soft blue, just for tonight?

Good. I always have liked blue. ■

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Edward Rietman & Michael F. Flynn

FAT-EATING LOGIC BOMBS AND THE VAMPIRE WORM

THE WORM FROM HELL

Shortly after 6:30 P.M. on 2 November 1988, daemons struck the Net. Computers across the country went catatonic. Berkeley's Experimental Computing Facility and the Rand Corporation at Santa Monica were among the first to crash. An hour later, the MIT Artificial Intelligence Lab froze, then Lawrence Livermore and the University of Maryland. Other nodes toppled like dominoes: Stanford, Princeton, Los Alamos, NASA's Ames Research Center, the Army Ballistic Research Lab. By the early morning hours, InterNet was virtually paralyzed. Only AT&T and Bell Labs were immune.

Investigating the mysterious slowdown, students at Berkeley's Experimental Computing Facility discovered a small, rogue program running under the user name *daemon*. This was a label of convenience normally

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used by "housekeeping" utility programs, but the rogue had usurped it for camouflage. While the students watched, it tried to attach itself to program after program, searching out portals into local area networks or back into the Net itself. Whenever it found a portal, the rogue threw a "grappling hook" through a loophole in UNIX's *sendmail* subroutine and hauled itself across to the new system. There, it would replicate and repeat the process.

They had found the Internet Worm.

One by one, system managers rousted out of bed in the wee hours took their systems off-line. This quarantine stopped the spread of the *daemons;* but it also severed communication among the experts trying to autopsy the worm. You see, accustomed as they were to using the Net for routine communication, the computer experts seldom knew one another's telephone numbers. . . .[1]

The Internet Worm—and its distortion in the popular media—brought computer viruses into the public spotlight. Unfortunately, since malignant or disruptive viruses are more newsworthy, the public has the notion that viruses are a Bad Thing. Nothing could be further from the truth. Like any other tool, a virus is only as good or bad as its user. Sure, viruses often erase data; but sometimes you *want* to erase data. In fact, viral programs can vastly increase our computing power. The processor of the future will be filled with the electronic analogs of platelets, antibodies and other such useful critters. Autonomous programs will run in the background "automatically updating software, diagnosing hardware problems, seeking out information stored in vast data banks or doing routine garbage collection" (Markoff, 1991). Vinton Cerf of the Corporation for National Research Initiatives calls these information-seeking viruses "knowbots" and predicts that someday they will assemble personalized morning newspapers based on each individual's interests (Daviss, 1991). Parallel processing on virus-managed distributed systems will even allow computers to walk and chew gum at the same time. In particular, "antibody" viruses—the equivalent of leukocytes—can help protect systems against malicious invading viruses.

DARWIN & THE ORIGIN OF ELECTRONIC SPECIES

Professionals had been dealing with viruses for many years before the InterNet Worm hack. Fred Cohen of Lehigh University began experimenting with them on a VAX 11/750 in the Fall of 1983. He coined the

[1]See Hafner & Markoff, *Cyberpunk: Outlaws and Hackers on the Computer Frontier* (Simon & Schuster, 1991), 251 pp et seq. for details on the Internet Worm hack. Robert Tappan Morris, Jr., the worm's author, had pointed out the *sendmail* loophole during a talk to the National Security Agency that summer. Morris's father had worked at AT&T Bell Labs before joining the NSA, so the Bell people heeded the warning, plugged the loophole, and informed other UNIX users. But the other users thought Bell was "paranoid." Rumors later arose that the whole affair was an NSA "op" to test Net security. These rumors were heightened during Morris's trial when the prosecution withdrew from evidence a videotape of Morris's NSA talk after the defense threatened to disclose classified information if it were shown.

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term *virus*, calling it "a program that can infect other programs by modifying them to include a (possibly evolved) copy of itself" and further stated, "Every program that gets infected may also act as a virus and thus the infection grows." (Cohen, 1987). The concept is analogous to biological viruses, which "hijack" cells and use them for replication.

However, viruses are older than their name. In 1962, Doug McIlroy and Victor Vyssotsky of Bell Labs created the game DARWIN, in which programs competed with each other for computing resources and memory. The winner was the program that could "kill" (erase) its competitors. Bob Morris, Sr., who worked under McIlroy, ended the game when he developed an *adaptive program* that "learned" how its competitors defended themselves, and changed strategies accordingly. It was invincible.[2]

Darwin led to Core Wars, popularized by A. K. Dewdney in a series of articles in *Scientific American* (1984, 1985, 1987) and in his book *The Armchair Universe* (1989). The game was refined by William Buckley (1989) in the "Core Wars Colosseum." In the Colosseum, two gladiator programs fight "to the death." Buckley has written a game program that includes an assembler for core war programs and graphics of the battling programs.[3] By placing the combatants in video memory (and confining them to that region of the system!) it is possible to watch the programs battle each other on screen (See Figure 1). While the programs compete, you can often see limit cycles and attractors develop within the graphic memory. This implies a complex dynamic evolving from simple rules.[4]

An early battle program was Dwarf, which occupied only four consecutive memory locations and lobbed a 0 into every fifth address. Running in RAM with another program, even a much larger program, DWARF could destroy enough of its opponent's code to render it useless.

But only if its opponent stood still. Against Gemini, Dwarf fights gallantly, but in vain. Gemini, only ten instructions long, copies itself to every 100th address, making it an artful dodger as well as an early example of a worm. A *worm* is a replicating program that does not need to attach itself to another program to survive.

CREEPER was written in 1971 by Bob Thomas, a scientist at Bolt, Baranek & Newman, who was working on air traffic control networks. Creeper simulated an airplane flying from one control zone to another by "flying" through the network, displaying the message: *I'm creeper! Catch me if you can!* on terminal after terminal. Finally, someone wrote a program called Reaper that roamed the system killing Creepers. Reaper was the first "antibody" virus.

It may be that Creeper and Reaper were the inspiration for John Brunner's 1975 novel, *The Shockwave*

[2]Bob Morris's son, Robert T. Morris, Jr., wrote the Internet Worm.

[3]Available from AMRAN, 5712 Kern Drive, Huntington Beach, CA 92649-4535.

[4]OK, so we all knew Chaos Theory would show up somehow or other....

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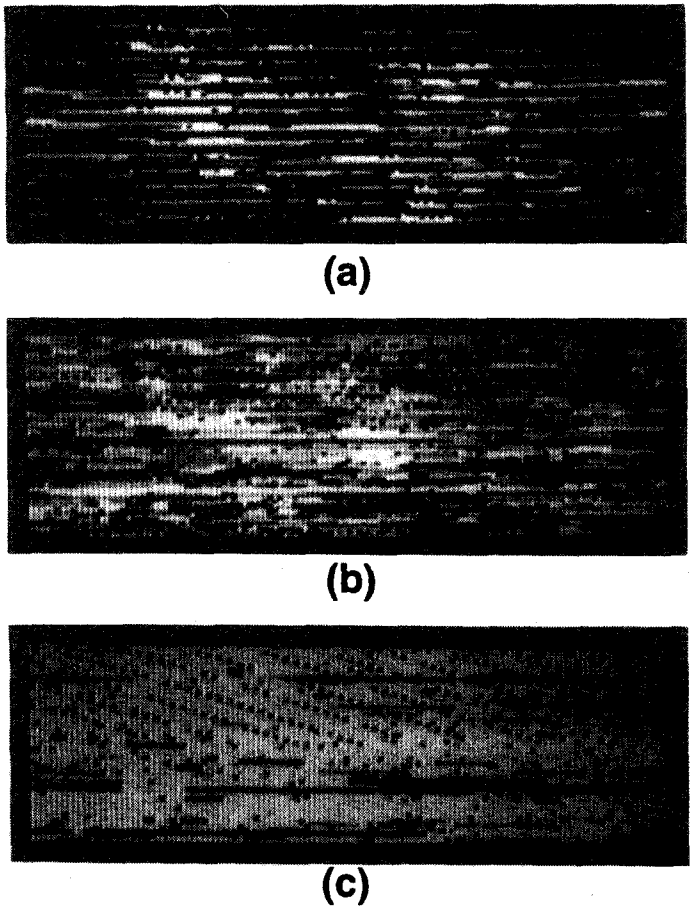

Figure 1: *Three stages in a Core War battle between WORM (gray pixels) and MICE (white pixels). The top figure is early in the battle, the middle figure is later, and the bottom figure is the end of the battle.*

Rider. Brunner called these programs "worms." John Shoch and Jon Hepp (1982) at Xerox's Palo Alto Research Center co-opted the term when they began experimenting with such free-running programs a few years later. A worm in a network can spawn new segments that become individual worms, similar to the core war programs described above. Worms released in a network can eventually (in minutes to hours) occupy all the time

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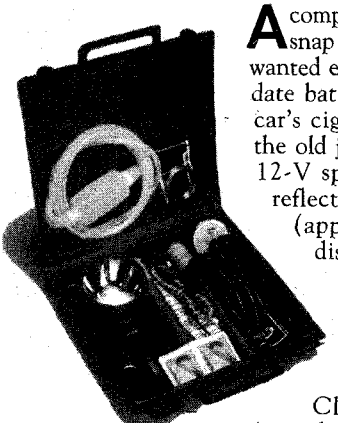

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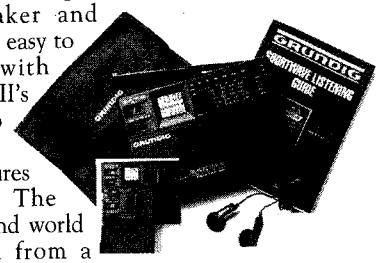

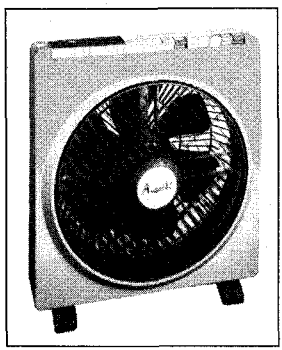

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and resources of the machines in the network. The Internet Worm, described by Denning (1989), was tying up resources in thousands of computers, nation-wide within hours of its release.[5]

What do you get when you cross Gemini with a Dwarf? Answer: a modern computer virus. The anatomy of a typical virus consists of two "organs," the infector and the detonator (Minasi, 1991). The infector is a Gemini-like program that copies the virus onto a target. The detonator is a Dwarf-like program that carries out the virus' mission. The mission may be malignant or benign. A virus is thus a pair of hands with gonads. More elaborate viruses may include adaptive features that allow it to grow and evolve, or *stealth* features that serve as camouflage. In an analogous process, the earliest eukaryotes apparently evolved when primitive replicating molecules began to cohabit in cells, specializing as chloroplasts, nuclei, and such (Margulis, 1981).[6]

The analogies between computer viruses and biological viruses are striking enough to be worth a short detour.

LIFE AS WE DON'T KNOW IT

Cohen adopted the term "virus" because of the similarities between his self-replicating programs and Mother Nature's self-replicating molecules. Both are "dynamic information patterns." In the one case, the information is encoded as bits on a disk; in the other case, as bits on a DNA strand. But all information systems share common structures and behaviors, regardless of the medium they run on.

SIMILAR LIFE CYCLES. The biological cycle is well described by Cherfas (1982) in his book on genetic engineering. Viral information is packaged in a protein envelope (↝ *vector, or carrier program*) that can puncture a cell wall (↝ break security) and inject the DNA into the host cell (↝ copy into the system). The host (↝ operating system) copies the viral DNA (↝ viral program) at the same time that it copies its own. The host then ruptures (↝ outputs), releasing the new viral particles to infect other cells (↝ via modem or floppy).[7]

SIMILAR STRUCTURE. A computer file is written in fragments into whatever addresses are available. These fragments need not be consecutive, but they are tagged by identifiers and pointers so that they read consecutively. Similarly, a gene resides in a mosaic of addresses on the DNA helix. These *exons*—sequences of "sensible" nucleotides—are separated by long stretches of "senseless" fragments called *introns*. The "operating system" doesn't see the junk, and the gene is "read" as a single, connected sequence.

[5]This was unintentional. Frustrated that no one had heeded his warning about the *sendmail* loophole, Morris had simply wanted to call attention to it. Unfortunately, an error in the code caused the worm to replicate too often and clog the system.

[6]Eukaryotes include every living thing except bacteria. Petunias, humans, mushrooms and coral reefs are much more closely related to each other than they are to bacteria. Can't you tell by the family resemblance?

[7]Old-time readers of *Analog* may recognize the ↝ as John Campbell's symbol for "is analogous to . . ."

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SIMILAR OVERWRITING PROCESS. Erasing a program removes only the tags and pointers, not the bits themselves. The file becomes "invisible" to the operating system, which now considers the addresses available for re-use. As new *saves* are made, these addresses are gradually overwritten by new data. Thus, at any given moment, the disc contains a mosaic of current and fossil file fragments. There may even be multiple copies of segments, because a *save* need not rewrite the same information into the same addresses each time.

Neither is genetic information "erased" by evolution. Although gradually overwritten as nucleotide triads are recruited for new tasks, large fragments (and copies of fragments) of obsolete genes survive as introns. Somewhere, deep inside us, we may still hold a few instructions for building Neanderthals. These bits and snips of left-over genetic instructions are sometimes called "junk genes" (Dawkins, 1976). In the human genome, junk genes and other introns make up 99% of our DNA.[8]

SIMILAR BEHAVIOR. More elaborate viruses possess additional features. Some are *adaptive*, the descendants of Bob Morris's victory at Darwin. Others can camouflage themselves. Since a virus usually hides in the boot sector of a disc, anti-virus scanners generally search there for distinctive viral "signatures." A *stealth* virus reacts to *read* attempts essentially by holding up a picture of a happy, peaceful boot sector. A *Trojan horse* is a program that appears to be doing something harmless or even useful while, behind the scenes as it were, it is doing something else. An example is Sexy Ladies, a HyperCard stack that erases a Macintosh's hard drive while displaying cheesecake images on the screen.[9]

Viruses have been written that can a) grow, b) replicate, c) travel, d) adapt & learn, e) attack & defend, f) camouflage themselves, and g) "eat" resources. With all these analogs, can we then say that a computer virus is alive? Do we demand any more of a Bengal tiger or a Northern spotted owl? It's a tough call. What is Life? Not all scientists agree that bio-viruses are "alive." On the other hand, there are some folks who claim that the entire biosphere, Gaia, is alive. Crystals grow and replicate, too. Does that make them living things?

Biologist James Miller concluded that all "living systems" share a common structure of nineteen subsystems that process information and/or matter-energy (Miller, 1978; Freitas, 1980). His list of living systems includes cells, organs and organisms, and even organizations and nations.[10]

[8]Well, we don't use 99% of our brains, either. Why should the body be any different? Think of the potential for genetic engineering implicit in the mass of "fossil" genetic information stored in our very own DNA! If we could one day restore some of the tags and pointers, we may be able to perform the bio-engineering equivalent of a crashed disc recover. In Greg Bear's *Blood Music*, the protagonist, Vergil Ulam, coded biocomputers and biologic into the junk DNA.

[9]Sexism thus bringing on its own punishment. Another example is the worm that Sarah Beaumont wrote in Michael F. Flynn's *In the Country of the Blind* (Baen, 1990). Disguised as NetMail, it set about downloading all the Bad Guys' files into police and newspaper computers.

[10]For example, a cell's membrane and a nation's border/custom guards are *boundary* subsystems that regulate the flow of both information and matter-energy between the system and its environment.

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However, most of us would not regard *Analog* or a spleen—or even Gaia—as being "alive" in the same sense as Stan Schmidt, a redwood tree, or a methane-producing anaerobic bacterium. There is something special about being an organism.

Living systems thumb their noses at the Second Law. They are *dissipative structures*, that is, they lose heat to the environment; but they "cheat" entropy by absorbing energy from the outside.[11] Maturana and Varela (1980) defined living systems as *autopoietic*; that is, as autonomous, self-referring, self-constructing systems. Rietman (1989) has shown that, since the dynamic pattern of a dissipative structure is autopoietic, it must be an information storage unit. And a dissipative structure, such as a strange attractor, is also an information generator. In the case of a life form, "information generation" consists of growth and self-reproduction through metabolism.[12]

In principle, none of this excludes autonomous, self-referring, self-constructing, energetically open *electronic* systems. So, computer viruses may well be "living things." But, if so, they are definitely not Life As We Know It.[13]

A DAY AT THE VIRAL ZOO

One of the first viruses to escape from computer labs and Core Wars Colosseums was the Lehigh virus, which infested the library computers at Lehigh University in the fall of 1987. The library was loaning computer disks to students, so this virus spread quickly to a microcomputer lab on campus and reached epidemic proportions. Students finally debugged the viral code and wrote a reaper to attack the initial one. Lehigh is an example of a FAT-eating logic bomb.

FAT-EATING LOGIC BOMB?

Viruses come in all shapes and sizes, and differ from one another in many ways, not the least of which is in their malignancy. To simply call them "viruses" obscures these distinctions and may lead us to forego beneficial applications because of the term's association with sabotage and pranksterism. When Fred Cohen recently offered a $1,000 annual prize for the most useful new computer virus, computer security specialists the world over reached for their smelling salts.

The biggest distinction is that between worms and parasites, that is, between free-running programs and those that must attach themselves to an operating system. However, we may also classify viruses genetically and ecologically, that is, by structure and function.

A "genetic" classification is based on a comparison of the code. Programmers often incorporate existing programs in their work, modifying and changing the instructions to accommodate new features. As *Eohippus* evolved into *Mesohippus*, so too does Version 6.1 evolve into Version 6.2. Sometimes there is a major mutuation, and we get Version 7.0. . . . Hu-

[11] Well, they can cheat for a while. In the end cheaters always get caught. . . .

[12] Or, sometimes, of writing articles for magazines.

[13] More about Life as We Do/Not Know It in another article we are noodling with.

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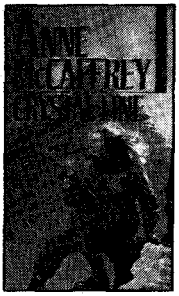

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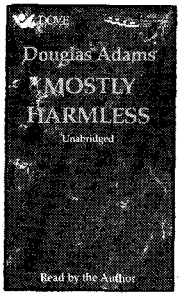

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mans and chimpanzees are related because they share 99% of their DNA. Similarly, the code for the Michelangelo virus, recently in the news, was apparently derived from that of the Stoned virus (a.k.a. New Zealand or Marijuana).

The Lehigh virus, discussed by Highland (1988) and Lendell (1989), was a viral infection in the *command.com* file discovered on several floppy disks in the university library. Whenever a floppy was inserted into an infected PC, Lehigh would peek over DOS's shoulder (so to speak), notice *command.com*, and attach itself like a leech—in the hope that the floppy would be used some day to boot another PC and spread the infection.[14] After making four such infections, the detonator was triggered. This makes LEHIGH a *logic bomb*. A logic bomb is a detonator triggered by a requirement, such as "after four infections, do this..." Logic bombs pre-date viruses. In the "old days," disgruntled programmers at large corporations would sometimes hide logic bombs in the accounting software with a trigger reading "if you don't see my name on the payroll any more, erase all the payroll records." Post-termination revenge. "Logic bomb" was a category in the *New York Times* index for several years before "Computer Virus" appeared. These early programs were pure detonator and lacked a replicating infector "organ," so they were not viruses, *per se*.

A second class of detonators is the *time bomb*. A time bomb, such as MICHELANGELO or Friday the 13th, will detonate on specific dates or times.

When Lehigh detonated, it destroyed the disk's index, or file allocation table (FAT). The FAT is the first thing the computer reads when accessing a file. It tells the computer where to find the sought files. Modifying the FAT is like ripping the index out of a book. The information is still there, but it's *much* harder to access. Lehigh is, thus, a FAT-eating logic bomb.[15]

An "ecological" classification is one based on the virus' mission. The most primitive missions, like that of the original Dwarf, are to lob bombs or wipe out documents, files, or applications. More sophisticated detonators cause unusual screen displays, such as messages. The ZUC virus, discovered in Italy in March, 1990, infects Macintoshes and causes the cursor to bounce around the screen like a ping-pong ball. The Cascade virus infects PC's and causes the letters being typed to fall into a heap at the bottom of the screen.

Highland (1988) made a list of different types of viruses, as shown in Table 1.

There are relationships among these "species." Since destroying the file allocation table also destroys the directory, we may regard FAT-eaters (type 1) as a subspecies of Directory Overwriters (type 10). Program Erasers (type 3) and Reformatters (type 9) are related, because reformatting a disk or certain sectors/tracks will

[14]Think of the way plants broadcast their seeds in the hope that wind, bird, insect or animal will drop it in fertile soil....

[15]See? It did make sense, after all.

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TABLE 1

COMPUTER VIRUS TYPES

1. Destroy FAT.
2. Change disk assignment.
3. Erase specific programs.
4. Alter data in files.
5. Create bad sectors.
6. Suppress execution of RAM resident programs.
7. Decrease free space on disk.
8. Write a volume label on the disk.
9. Format specific tracks or entire disk.
10. Over-write disk directory.
11. Hang the system.

erase the files. However Program Erasers may target specific applications, while Reformatters wipe out everything. Bad Sectorizers (type 5) and Free Disk Space Eaters (type 7) also have similar effects. Creating bad sectors certainly will decrease the free disk space. Of course, free space could also be used up by madly replicating virus programs. RAM Suppressors (type 6) and Hangers (type 11) are related. To cause a RAM program to dysfunction could result in a system crash.

Disk Assignment Shufflers (type 2) seem harmless enough; but if the program needs information from the disk or needs to write to a file, then the end result is a system crash or an error message.

None of these above operations are necessarily malicious. In fact, there are actual operating system programs to perform these operations. It is only the *timing* of these activities that may be inconvenient for the user. However, even non-malicious viruses occupy disk space. Also, since viruses

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live at very low levels of the system, unexpected, "emergent" properties may cause them to act in ways unintended by the author. Furthermore, many prank viruses contain errors—some hackers aren't as smart as they like to think they are—and these errors may cause disk crashes and other troubles.

Based on the above analysis we propose the virus taxonomy graph shown in Figure 2. The "family tree" should be self-explanatory.

A few examples of viruses:

The Pakistani Virus (type 11) is described by Lendell (1989) and Highland (1988). The Alvi brothers in Lahore, Pakistan, operated a small computer repair shop and wrote custom software. When they discovered that pirated copies of their software were being sold in Lahore they wrote a virus protection program called *Brain*, which they hid in the volume label. (The volume label is simply a label for the contents of the disk.) Most users never access this region of the disk, so information (such as a virus) can be hidden there. The Alvi brothers designed the volume label to simulate computer errors if a pirated program disk was used. The virus would also print a message that the Alvi brothers in Lahore, Pakistan could be contacted for repair. It became one of the most widespread computer viruses ever.

The Hebrew University virus (type 9) has been described by Highland (1988) and Kane (1989). The virus, reportedly developed by the PLO, was a time bomb set to wipe out files at the Hebrew University by reformatting certain sectors on the disk. It was set to "explode" on Friday, 13 May 1988, the 40th anniversary of the last day Palestine was recognized as a political entity. The virus was discovered in December, 1987, and destroyed shortly thereafter. Other versions of this virus show up as Friday the 13th time bombs that explode on *any* Friday the 13th.

The Amiga virus (type 11) is described by Highland (1988) and McAfee & Haynes (1989). When executed, Amiga automatically went to RAM and from there infected other disks that were placed in the disk drives during that work session. (If the system was turned off before other disks were placed in the drives

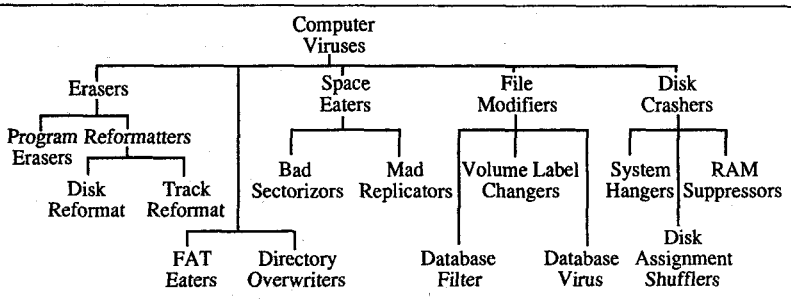

Figure 2: *A proposed taxonomy of computer viruses.*

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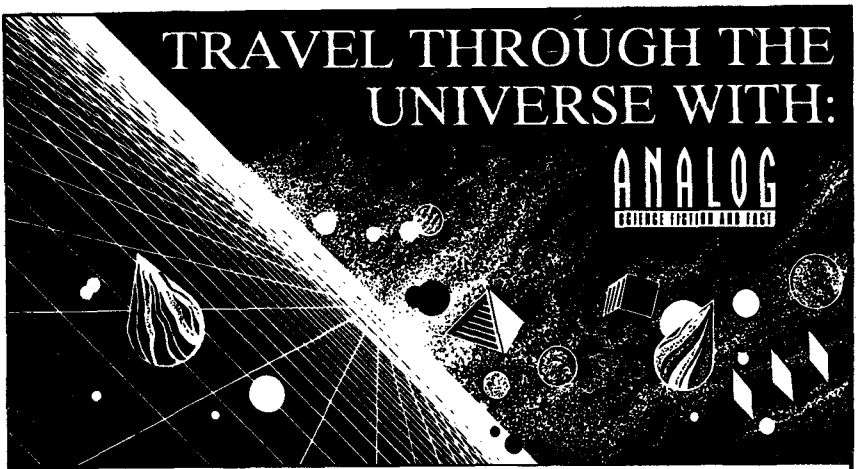

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then the virus did not get a chance to multiply.) After the system was running for a while it would display the message, "Something wonderful has happened—your machine has come alive." Following this, the system would hang and a reboot would be necessary.

The Christmas Tree virus (type 11)—described by Lendell (1989) and Highland (1988)—appeared on the IBM network in December 1987. The virus was a "messenger." It acted like a chain letter and did not attack or infect other programs. After infecting a node, the virus displayed a Christmas tree and Merry Christmas message. Then, it sent itself to everyone on that person's e-mail distribution list. It quickly infected many machines, necessitating a shutdown of the network to remove the virus.

Macintoshes have also been attacked by viruses. Some of them have been modified versions of viruses intended for DOS or UNIX environments. Others have been native to the Macintosh operating system. (Although they may conduct similar missions, viruses programmed for DOS, UNIX and Macintosh environments are like the carbon, silicon, and chlorine-based life-forms beloved of old-time science fiction: fundamentally different in their internal structure.)

Scores (a.k.a: Eric, Vult, Nasa, San Jose Flu) was designed by a disgruntled programmer to attack two applications programs under development by his former employer. But, since neither program was ever released to the general public, Scores is a smart bomb without a target. Scores infects the Macintosh's *System, Note Pad* and *Scrapbook* files and creates two "invisible" files, *Scores* and *Desktop* that cannot be seen on the user's desktop. The infection causes abnormal *Note Pad* and *Scrapbook* icons to appear on the user's desktop. Two days after infection, Scores starts infecting applications. It does not do anything but replicate and look for its two specific targets; however, errors in the program sometimes cause the system to hang.

Another Macintosh virus, nVIR, plagued one of the authors of this article. nVIR comes in two versions, called nVIR A and nVIR B. An earlier, malicious version that destroyed *System* files appears to be extinct. Once it is in the *System*, nVIR begins infecting applications immediately as soon as they are run, without the delays built into Scores. Starting at 1000, nVIR counts down by -1 at each start-up and by -2 each time an infected application is run. After the countdown reaches 0, Scores causes the Macintosh to beep (with a specified probability) whenever the *System* or an infected application is started. If *MacinTalk* is installed in the System folder, nVIR A causes the computer to say, "Don't Panic." Annoying, but harmless to data. Disk resources are consumed and the system may hang more frequently. Interestingly, nVIR A and nVIR B can mate and reproduce, resulting in new viruses combining parts of their parents.

The ANTI virus appeared in France in early 1989. It differs from many

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other viruses in that it does not infect the *System* file, only applications and files that resemble applications. It is more contagious than Scores and nVIR because it can infect applications even if they are not running. However, it can only operate under the *Finder*, not the *MultiFinder*. It does not attempt to do anything but spread itself, but a "genetic" defect in its code causes it to clear all the resource attributes of the CODE 1 resource, resulting in less efficient memory use.

Some criteria—loosely categorized—that may be used to classify viruses are:

A. AUTONOMY

A0) mules: cannot reproduce (and thus not true viruses) but may possess other features associated with viruses. (e.g. Sexy Ladies or pure logic bombs directly installed by programmers into a system.) Many of your system's resident utilities would be classified this way.

A1) parasites: pure viruses that need your system to reproduce.

A2) worms: self-reproducers; autonomous, free-running programs.

B. SURVIVABILITY

B1) suiciders: erase themselves following completion of mission.

B2) survivors: do not erase themselves, but remain and await the next opportunity.

B2) vampires: do not erase themselves, but withdraw to a "crypt."

C. CAMOUFLAGE

C0) no camouflage

C1) trojan horse: encrypted in another, apparently harmless program.

C2) stealth: presents an acceptable mask when probed by a virus scanner.

D. DETONATORS

D0) pure replicators: no mission beyond self-reproduction, but may hang or slow the system via overpopulation: the "red tide" or "lemming" effect. (e.g. Anti, Christmas Tree, the Internet worm).

D1) bombs: lurk in the system awaiting a cue to act.

D1a) time bombs: cued by clock, calendar (e.g. Jerusalem, Scores)

D1b) logic bombs: cued by fulfilling a condition (e.g. nVIR, Lehigh)

E. TARGETS

E1) system infectors

E1a) bootleggers: infect the boot sector of the disk.

E1b) label infectors: infect the volume label of the disk.

E2) application infectors

E2a) generic infectors: attach to any application.

E2b) specific infectors: attach only to applications of specified type.

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E3) database infectors: may be further classified according to the type of database file that is targetted.

E4) reapers: attack and neutralize alien viruses.

F. INFECTION TAG

F0) amnesiacs: do not recognize previously-infected files, and may reinfect them. (Reinfecting files is a waste of time, and causes infected files to grow noticably in size. This was how the Israelis discovered the Jerusalem virus.)

F1) taggers: "tag" infected files to prevent reinfection.

G. MISSIONS

G1) overwriters

G1a) erasers: remove data; overwrite addresses; reset counters.

G1b) replacers: alter data; insert non-random bits.

G2) copycats: make duplicates of files

G2a) misers: hoard or archive files.

G2b) gossips: transmit, download or piggyback files (e.g. Knowbots)

G3) hotdogs: create messages, screen displays (e.g. Stoned, nVIR A)

This catalogue is not exhaustive; additional categories are possible. For example, some viruses can infect applications only when they are open, others can do so any time the system is running. Neither is the list definitive—we made up some of the names ourselves.[16] The list is meant only to highlight basic features of viruslike programs. It is clear that many of these features could be used either maliciously or benevolently. For example, a type A2/B1/C2/D1b/E3/F1/G2b worm (2-1-2-1b-3-1-2b for short) is a suicidal, stealthy, gossipy logic bomb that tags and infects data files. When certain logical conditions are met, it will copy designated files and download them somewhere, then erase itself. Without the stealth feature, this might be the Knowbot that assembles your personalized newspaper from a public access wire service. But the stealth feature would indicate that the worm is lurking where it hadn't oughta, so it is likely designed for espionage.

THE GHOST IN THE MACHINE

Early in 1990, the AT&T phone system in the northeast crashed, shutting down service area-wide. This was not due to a virus, but to an unexpected incompatibility between two program modules. The code controlling the phone system is so complex that no single mind can encompass it. It must be assembled from pieces written by teams of many individuals. Under these circumstances, the code equivalents of "interference fits" and "loose wires" may take place, especially at the junctions of different

[16]...and were sorely tempted to call category B1) *mujahedin,* but we didn't want to get political.

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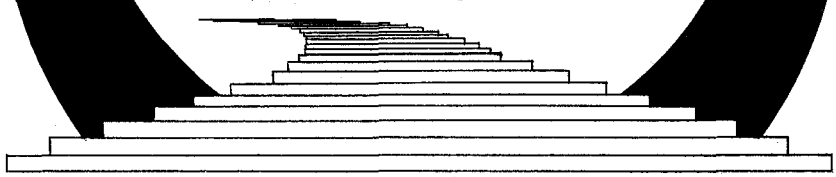

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modules.[17] The nightmare of every programmer is that some such interaction in a complex system may give rise to a *spontaneous virus.*

Is it possible for a random virus to evolve out of a good program?

Dowling (1990) showed that if an operating system is complex enough to allow users to copy programs, then inevitably—with high level programming languages—it will be possible for programs to copy themselves. Computer viruses are thus "an inevitable consequence of fundamental properties of any computing domain." Dowling's proof rests on the mathematical technique of *diagonalization,* which turns apparently sensible statements into paradoxes by making them self-referential.[18] Programs that operate on other programs *and* on themselves create an analogous self-referential situation.

So, spontaneous viruses are possible in theory. But how *likely* are they? Intuition is no help when probability is involved. Probabilities can be quite high when intuition says they are low, and vice versa.

●Given a mere 23 people, there is a 50% chance that two of them share the same birthday.[19]

●If one member of a pair is male, the probability that the other is female is 67%, *not* 50%.[20]

●Pick two card ranks, say jack and ace. The probability is nearly 50% that, in a well-shuffled deck, a jack and an ace will be dealt back-to-back.

Furthermore, even extremely rare events have a high probability *given enough opportunities.* A once-in-a-billion event has one chance in eleven of occurring given "only" a hundred million opportunities! And everytime a program (or a DNA molecule) is copied, there are opportunities for mutations or bit-flips. Most mutations in biology are non-viable; but allow for zillions of organisms and zillions of replications and evolution is a dead certainty. So what does this tell us about mutations in computer programs?

Biological genomes have enormous redundancy and vast stretches of junk genes, so that most mutations have little or no effect. The organism can survive, procreate, and pass the mutation on. The fibrinopeptides, for example, have evolved at very nearly the base mutation rate, so the gene must be very robust. You can kick it, pinch it, and poke it with a stick, and it will still help your blood clot. But one and a half billion years after cows and peas parted genetic company, their histone H4 gene DNA texts differ in only two of 306 characters. A bit flip in histone H4 will nearly always crash the bio-system, so mutations are edited out. Similarly, a single bit-flip in a billion-bit program will most likely turn it into trash. The pro-

[17]It was the concatenation of two legitimate features in UNIX's *sendmail* that created the loophole for the Internet Worm.

[18]Footnote [18] is false.

[19]For prob/stat junkies, the probability of a birthday match in a set of n people is: $P = 1 - {}_{365}P_n/365^n$

[20]Since one of the pair must be an M, the universe consists of: FM, MF and MM. Two of these three equally likely pairs contain an F. (By the way, notice that in two-child homes three out of four boys are "eldest sons"—and ditto for girls. So is it really surprising that so many successful folks are "eldest sons/daughters"? But we digress...)

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gram will thus not survive, not procreate, not pass the mutation on to the next copy.

Yet, here is a scenario for a quasi-spontaneous computer virus. Imagine that a random bit-flip reactivates a fragment of de-tagged "junk" code left over from a previously erased file. Say, "go to address X" becomes "go to address Y." And address Y happens to contain a fossil program fragment with instructions for self-reproduction. Our computer will contract electronic cancer.

Starting with a 1000-bit program, of which 500 bits must be set correctly, Burger (1988) estimated the probability of a spontaneous virus emerging as:

$$P(V) \approx \frac{r!}{n^r} = \frac{500!}{1000^{500}} \approx \frac{56.05}{(2e)^{500}} \approx 10^{-366}$$

(Formula 1)

This is worse than one chance in googol-cubed, so don't hold your breath waiting for a spontaneous virus to pop up in your machine. The odds of pseudo-life emerging from pseudo-non-life are of the same magnitude as for biological life emerging from non-living matter. It could happen (otherwise we would not be here speculating upon it) but it is a low probability event.

However, John Koza (1991) has written programs, called *genetic algorithms,* that can mutate code. The algorithm views target programs as chromosomes, and replicates them by cloning. The programming allows for viable mutations. Under such conditions, evolution is inevitable. Although neither the algorithm nor its targets are initially viruses, once evolution commences, viruses will emerge.

How do we know this? Because it happened. Thomas Ray, an evolutionary ecologist, used genetic algorithms to create an artificial world inside a computer (Rennie, 1992).[21] TIERRA is an imaginary ecosystem consisting of self-replicating programs ("creatures") that compete for computer resources. Viruses emerged within the first few minutes of the simulation, thus confirming Dowling's theory. When chance mutation wiped out a major chunk of the replication code in some creatures, most of the "castrated" creatures would "die." But some survived by "borrowing" the replication code from other, complete creatures. (Ray had *not* programmed the creatures to do so.) An ecologist, Ray called these mutants "parasites"; but they are actually quasi-spontaneous computer viruses.

As TIERRA continued running, the "host" programs evolved protections against the viruses; and the viruses evolved to circumvent the protections. If a super-host emerged that wiped out all the viruses, new viruses would pop up again, via the original mechanism. One protection that emerged was the ability of host creatures to exchange code with each other.

They had discovered sex.... From a genetic point of view, sex is quite useful.

[21] Shades of Theodore Sturgeon's "Microcosmic God"!

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Hartman (1977) has speculated that bacterial viruses originated as rogue components of cell genomes; in effect, *escaped junk genes spread from one species to another.* This idea isn't as strange as it may seem. Virus-like vectors are often used in genetic engineering to transport genetic material into a host. Bio-engineers recently transported the gene for mucous-making into the lungs of test animals using a neutered cold virus, a first step toward a cure for cystic fibrosis. This happens in nature, too. Pea plants, alone among plant families, contain hemoglobin in their roots. Evidently, peas were once infected by a rogue animal gene, probably carried by a virus. Fruit flies (*D. melanogaster*) outside of laboratories contain alien DNA transferred by a mite that feeds on fruit fly eggs. Most such viral invasions result in the illness or death of the host—they hang the system—but in sexually recombining populations, the host's genetic material and the foreign genetic material could recombine to yield the first of a new species![22]

In the same way, an invading computer virus can transport computer code into a system in order to reconfigure resident programs to new or modified tasks. This can be done maliciously, to hijack the system; or it can be a quick means of updating your system.

* * *

[22]Thus, Bart Simpson's warning, "Don't have a cow, man," should be taken seriously. If we did start "catching cow," it would be an udder disaster. On the other hand, if we "caught" chlorophyll from the plants, sunbathing might help alleviate world hunger. . . .

DOMESTICATING VIRUSES AND WORMS, OR *USES WITHOUT USERS*

Computer viruses are *not* programs that exploit errors of the system. Programmers may take advantage of such errors in designing their viruses (as Robert Morris, Jr. did with the Internet Worm), but the viruses themselves are normal user programs using normal operations. They can lie dormant for many years as patterns on magnetic media; then, when executed (by time bomb or logic bomb), quickly reproduce and spread throughout the network to perform useful work.

They become a nuisance only when the use is not authorized. The best defense against such alien viruses is isolation/quarantine (Cohen, 1988). This is not desirable for the program sharing and networking of the 1990s. Since viruses spread by contagion, an obvious defense is limited transitivity, which means limited information flow in the network. Maintenance of a limited transitivity network is extremely difficult and is known in mathematics as an "NP-complete problem." However, it may be possible to create a database maintenance virus to manage such networks.

Current methods of defense include gatekeepers, scanners and other virus-detecting programs, such as the Dr. Panda Utilities described by Kane (1989). But, as Cohen points out, viruses can evolve; so the detector eventually becomes ineffective . . . *useless unless it, too, can evolve.* In other words, the virus protection program must itself be a virus

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(or worm): an *immune system* capable of adapting to viruses and other agents. This is not as difficult as it may seem. We already have neural network programs and genetic algorithms that can learn and evolve —descendents of Bob Morris, Sr.'s victorious Darwin contestant. It is only a small step to incorporate them into "white cell" reaper viruses.

Thimbleby (1989) and Thimbleby & Witten (1989) are using computer viruses for *database maintenance* in a hypertext-like environment. For example, in a simple database you might have a phone and address list on a computer at work and a similar one at home. If you add new addresses to your home database, you would need to copy the new database onto your work computer, either by disk or by manual reentry. Either one would require your attention. It is possible to use a virus to keep the two databases concurrent. A database maintenance virus could easily copy the floppy from your home/office to the hard disk at your office/home, without your attention except to insert the floppy disk into the drive.

Constructing a hypertext database is a rewarding task. Linking and cross-referencing data yields a quantum leap in the information content. But the database is only as good as the links; and planning and inserting the "buttons" is a painstaking task, not to be done superficially. Suppose we had a worm, called a *yentl*, with a neural net "brain" trained in indexing and cross-referencing. It could wriggle through documents inserting hypertext buttons as needed. Every new text loaded into the system would be automatically incorporated into the hypertext and juxtaposed with other texts containing related data, supporting or contesting it. The worm might even be taught to insert footnotes ("for contrary evidence see...") or to highlight previously unsuspected connections.[23]

A disk could hold far more files if they were stored in compressed mode using a Hoffman coding scheme. Cohen (1987) and Burger (1988) describe a *data compression virus* that could manage the amount of available memory by compressing and decompressing programs as needed. Idle programs or files would be compressed and tucked away. When run, they would be decompressed, while others were compressed to make room.

In a *distributed network* there will, at any given time, be idle machines. Wouldn't it be a good idea to put this computation power to use? A worm carrying a compute-intensive problem could seek out idle machines and copy itself into them. If the owner of the computer arrived, the worm would collect its data and leave to seek out another machine. Schoch and Hupp envisaged such a worm coming out at night, after all the human users had left, running on the network during the wee hours, then hiding in the morning when the wetware returned to work. Perhaps

[23]For example, the Rennie article cited in the bibliography concerned biological parasites, not computer viruses. Someone researching an article on computer viruses might not normally look there for information. A hypertext yentl would make the match and highlight it.

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inevitably, they called this a Vampire Worm.

There may be several such *vampires* oscillating in the network until they find a machine to use. Even during the day, nodes may be idle for short times. A few nanoseconds here, a few nanoseconds there, and pretty soon we're talking about real computing time.... This could be a useful method to *program massively parallel computers.* Most of the operating system would consist of worms that pick up user programs and distribute them to processors. In fact, a "worm with its boots on" is one way to boot massively parallel computers. Started on any node, the worm could carry the boot to all the other nodes on the network.

The idea of using worms for distributed processing on a network was first developed by Shoch & Hupp (1982). The individual computers in a network become segments of the worm and the segments remain in communication with each other. The worm mechanism is used to maintain the segments of the worm and to seek out machines to act as segments when more are needed. It does not seek more machines if the worm is the size specified in the worm mechanism program.

Another potential application of worms is to *seek out specific information from databases* spread throughout a network of computers. These worms could travel through the network producing other worms that are not necessarily clones of themselves. These slaves could retrieve data requested by the master worm. The master worm could then take the information to its host computer. You could sit at your desk and send out a worm to do an information search, say, for a particular molecular engineering technique. Within seconds the worm could generate enough slaves to search all the databases in a world wide network. Or, as previously mentioned, it could assemble a personalized newspaper.[24] Obviously, these worms must self-destruct after they deliver their information. Otherwise the network could soon become clogged with useless worms.

CONCLUSION

Parasite viruses and worms will be with us in the future; so the only real question is whether we will use them constructively to augment our cybernetic abilities or abandon them by default to the pranksters, the saboteurs and the government. Our bodies could not function if every breath, every infection, every beat of our hearts required our conscious intervention. (Certainly, we wouldn't get much sleep!) Our computer networks likewise can function far more effectively if they have an active system of autonomous programs performing useful work without user intervention. ■

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[24]What happens when everyone reads personalized newspapers? You will never learn anything that you weren't already interested in. Until some benevolent harlequin infects your knowbot with random surprises.

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IN TIMES TO COME

A couple of years ago you, the readers, voted Maya Kaathryn Bohnhoff's "Shaman" one of your favorite novelettes of 1990. Next month Rhys Llewellyn, that story's irrepressible and highly unconventional interplanetary negotiator, returns in *Squatter's Rights,* a two-part serial wherein he faces a unique problem. What do you do when you've gone to considerable trouble to establish a colony on an idyllic new planet, and then a group of decidedly alien aliens comes along to assert what may be a legitimate claim to it? Well, there's the obvious "solution," of course, if you can pull it off; but Rhys Llewellyn doesn't go in for the obvious!

The rest of the fiction line-up includes novelettes by Doug Larsen and Grey Rollins, and short stories by Rob Chilson and Jeffery D. Kooistra. Dr. Stephen L. Gillett provides the fact article, in which he looks at a novel—and *very* fundamental—hypothesis for resolving the Fermi Paradox.

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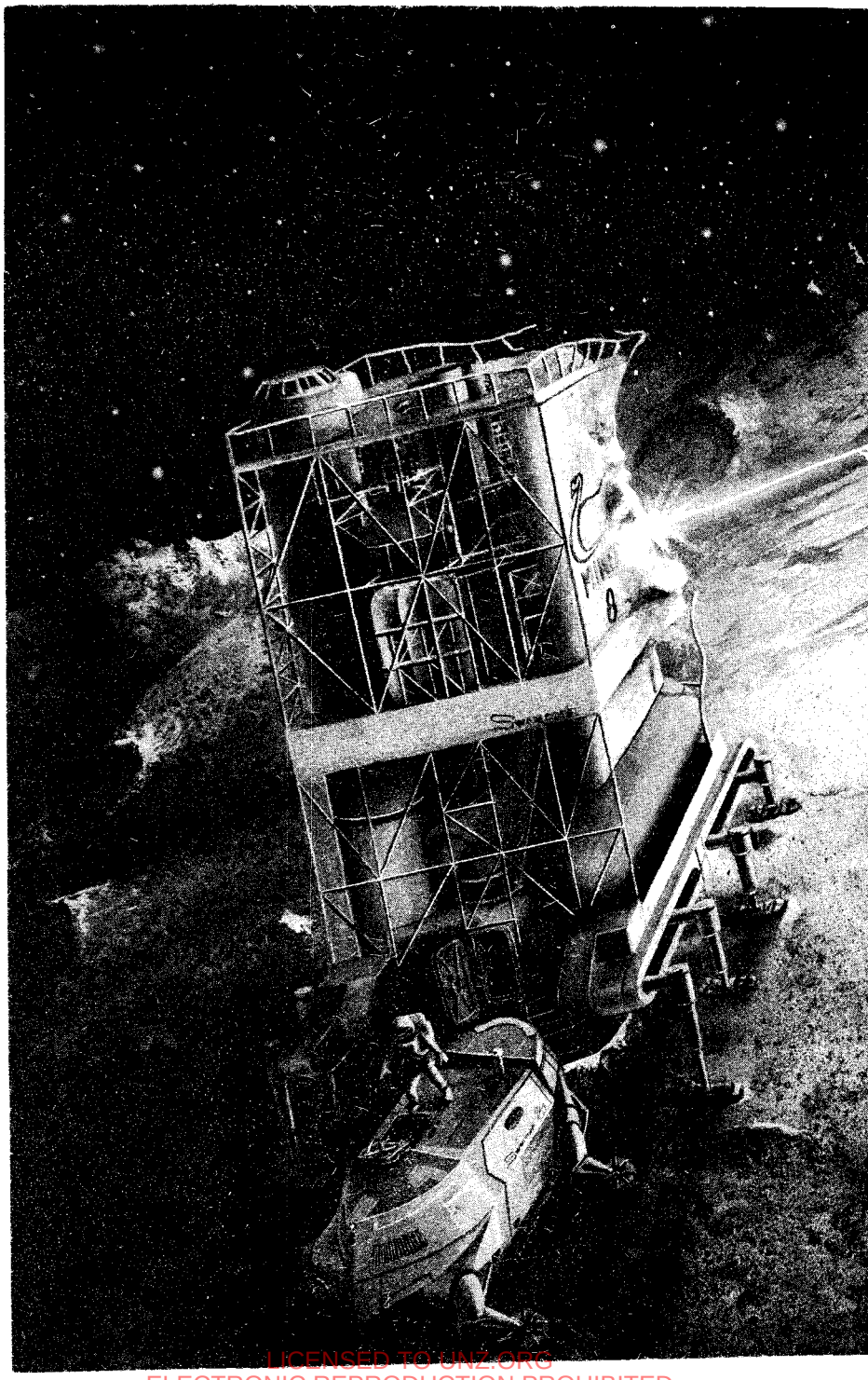

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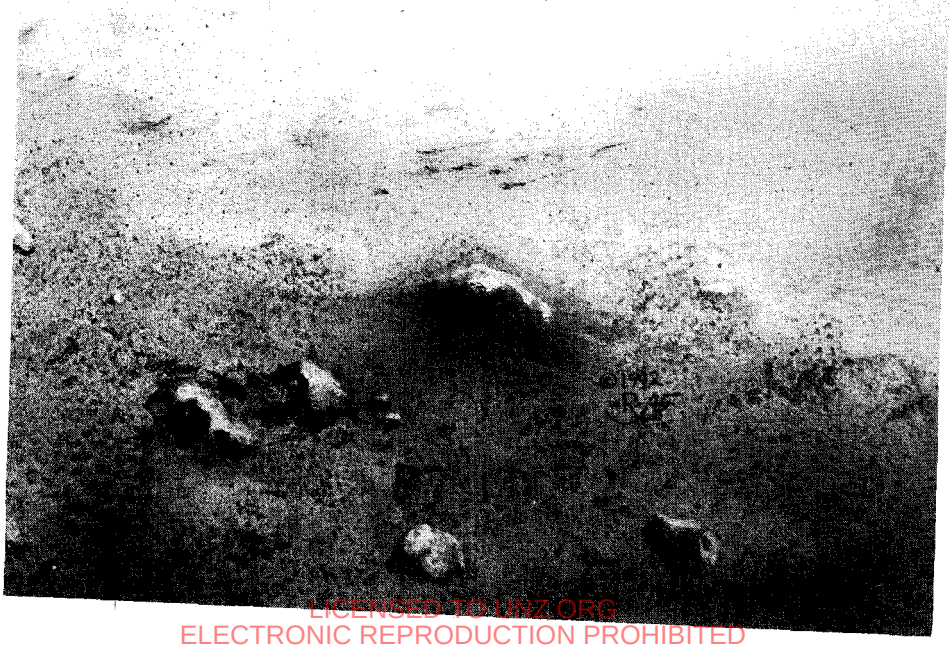
HYDRA

Ian Stewart

In many cases the obvious solution is wrong—but seldom more wrong than in this case!

Illustration by Randy Asplund-Faith



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Hag Swanling's eyes flickered towards the well-groomed, nervous young man. He reminded her of Stavro, which in turn reminded her of—*sod you, Stavro.* She watched as his eyes slid from the desktop terminal to the hologram of the founder to his polished cutaway boots, anywhere except her face. He was terrified.

"This dossier, dear," she said, tapping a bony finger against the cover. "You guarantee it is complete?" He cleared his throat to speak. "I hope you're right," she continued, as the words half formed on his tongue. Her sense of timing was exquisite, and it threw him off balance. She pressed home the advantage. "It is not SwanCorp's custom to rely on hope, dear. *Is* it complete?"

"In—it is as complete as possible in every pertinent detail, Director."

"And there is nothing in it to justify removing Pirelli from the project." The young man remained silent, puzzled. "Take this away and keep it up to date. I will inspect it from time to time." Her voice spoke dismissal, and he bowed respectfully and left, sweating, while she wondered whether the time was yet ripe to—no, not another Stavro, certainly not within the corporation.

"You do yourself no good, Grace, with this vendetta against Diamond Pirelli."

Hag smiled sardonically. "Thank you, Byrd, for your advice."

"You know that act doesn't wash with me, Grace. What have you got against the young woman, anyway? She's a natural. Everybody supported her except you. Something personal?"

"Female intuition."

"Rubbish. You could have vetoed the appointment."

"Byrd, when you're fighting a war you save the big guns for the big targets."

"You're satisfied with Pirelli's performance, then?"

"Not in the least. I'm looking for evidence to convince the board it made a mistake. I agree she appears to be handling the job well. To date. I just don't think she'll keep it up for the rest of her term."

"Grace, you're worrying about nothing. I have every confidence in Pirelli."

Microgravity makes two things easier: coping with a heart condition, and sex. Nobody with a heart condition survives lift-off, which gets rid of one advantage. SwanCorp had wrestled with the other for thirty years, and made the best of a bad job by settling for all-female crews. That leaves the things microgravity makes harder, which are everything else. Even drinking beer is an arcane art form. Brewing alcohol is better than smuggling psychedelics, so the corporation turns a blind eye as long as it doesn't interfere with business; and as a practical matter there are precious few police in the asterbelt.

Diamond Pirelli had rigged a pump to siphon off the liquid, while "Hell" Shackleton and Tonia Bradbury offered advice—none of it helpful. And just as Di was draining the last inch of homebrew, just as the dioxide bubbles threatened to break into the plastic line and dredge yeast sludge into the motor—one of the MINERs chose to go on the blink. SwanCorp is very touchy about the mental health of its Multipur-

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pose Intelligent Neuronet Exploration Robots. Beer spiraled from the tank as Diamond kicked herself across to the comm alcove. She cursed as she flew: it would take hours to dismantle the Dome's circulation fans and wash off the sticky film.

Thus do sixteen women amuse themselves alone on an asteroid. Tonia had christened it Rockoon, a private joke too complicated to explain. There were twenty MINERs on Rockoon, each roaming at will through its own triangular patch, centered on the vertices of an icosahedron, tethered to those centers by laslink.

Only now there were nineteen.

"MINER-8's down. That's all we need. We're already a kiloton under target." Tonia, duty software engineer, tried to download a diagnostic, but the laslink was dead as a dolphin. MINER-8 was farside, well out of direct vision.

"Ya want me to whistle up Rover?" asked Hell, one of their electronicists, who was blonde, plump, and an inch short of five feet tall.

"Ask the organizer whether the budget'll allow it."

Hell wrinkled her nose in disgust. "No point—hydrofuel account's already overdrawn."

Finally Tonia worked out a way to reprogram MINERs 2, 7, and 9 to hook up their sensors line-of-sight and relay coarse visuals. She ran her fragile fingers through her fuzz of cropped black hair. The incoming pictures made no sense.

"Come over here, you two. Tell me I'm seeing things."

Diamond loped over. "We lost a MINER?"

"No," said Tonia, puzzled. "We gained one."

"We gained *something*," said Hell, peering over her shoulder. "MINER-8 looks sick." It was visibly drooping, a disturbing attitude for a machine fifty feet high and half as wide. No more than two hundred yards away was another structure, not on any survey map, about half the size. Unlike the missing MINER, it didn't droop. In silhouette it looked menancingly alert. Around the base it shimmered, like heat haze on a horizon.

"Great. Had to happen on *my* shift. What do we do?"

"Play it by the book, if you want to keep your job, darling."

"If you can show me where the book says what to do when a lump of machinery suddenly materializes from nowhere, I'll give you my share of the beer."

"Fat lot of good that is when you've sprayed it all over the Dome."

Hell had been turning pages. " 'In order to maintain accurate record-keeping, any unexplained event or object must be provided with a code name.' "

"Monstrous machine, I dub thee . . . Oddity!" said Diamond. She toyed with signaling central directorate on the emergency band, but the cost wouldn't really be justified, and Hag would have her job. . . . Funny she hadn't vetoed the appointment to begin with. You could get really paranoid about that: get somebody stuck on a lump of rock to which you alone control access, and then . . . but she'd been over that ground long before. If Hag wanted to get rid of her, there were cheaper ways, with no innocent by-

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standers.

Finally she chose the lesser evil, told Hell to whistle up Rover anyway, suited up, and climbed aboard. "Yes, I'll be careful. No, I don't need a spare radio. Of course I've checked my oxygen levels, food, water! Hell, you're as fussy as an old maid!"

"That, dear, is because she *is* an old maid."

"Sensible girl. Giddy-up, Rover!" She told the vehicle where to go and it loped across the cinder surface on huge soft bubblefeet.

Rockoon is a pockmarked potato, hollow on one side with a fault-plane that cuts right through, slicing it like the top of a boiled egg, and creating a ring of cliffs varying between zero and two hundred feet. MINER-8 was a four-hour lope from the Dome. Rover's neural nets hummed as it adjusted its stride to the local terrain. *This*, thought Diamond, *is the first interesting thing that's happened since I arrived.* Until now, all she'd done was make MINERs stockpile metal according to SwanCorp field directives, waiting for the next launch window to sling them into the hungry jaws of the motherprocessors. A cloud of dust trailed behind, swept from the rock by Rover's pounding feet. It would take weeks to settle. Some would end up on Jupiter, a million years later. Diamond sang as Rover accelerated, breaking into a slow trot.

She passed MINER-2, and celebrated by opening a pack of home-brew. By the time MINER-7 appeared against the backdrop of stars she was on her third beer, and her songs were becoming less inhibited. A random line reminded her of Hag Swanling. Oh, if only the stupid woman realized . . . but then, there was no way to tell her, never would be, she'd never listen anyway. . . .

As they neared MINER-8 the songs died, and Diamond told Rover to drop back to a cautious walk. They swung in an arc to keep the drooping robot roughly between themselves and Oddity.

Parts of MINER-8 had melted. That explained the drooping look, Di thought, and started to worry. Rover prudently extruded a periscope and kept below Oddity's horizon.

The enigmatic object was obviously a machine. Since it couldn't have built itself, it must have come from somewhere else, doubtless one of the other ecoblocs. On board every MINER was a synthetic neural memory bank capable of holding more than a billion videoframes: *everything* that happened to it was recorded for possible future use. If MINER-8 had seen Oddity land, there would be a record. By time-reversal of the trajectory it would be possible to estimate the strange machine's place of origin, maybe decide which bloc had launched it. Her guess would be Pacific Trading, it had that funny angularity of all their robot designs. All she needed to do was sneak up unobserved and—

The tip of the periscope flared into droplets of molten metal and the viewscreen blanked. Escaping air screamed like a siren until Rover's sandwich skin flowed and gelled, sealing the hole. Diamond wasn't going to leave now without getting MINER-8's memories. Rover skipped sideways, putting the drooping metal hulk squarely between itself and Oddity. It partially deflated its feet to hug the ground more closely,

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then crept towards the damaged MINER.

It was within twenty yards of its goal when Oddity noticed it. An energy beam flared, and MINER-8 spat liquid metal. Parts glowed white-hot, slumped, and ran like candlewax. She knew it was crazy to enter the machine when it was melting, but she didn't lack physical courage, and the home-brew clouded her judgment enough to tip the balance. The memory bank was on the second level, not twenty feet from the hatchway, and she told herself there was an awful lot of solid metal between her and the hostile machine.

MINER-8's walls began to crumple.

She unclipped the memory bank from its mountings, and ran. Behind her, cables in the ceiling dripped molten insulation. She hurled herself aboard Rover. Its neurocircuits whined as the vehicle went into an unstable reverse canter, lurching erratically on partially deflated bubblefeet. MINER-8 exploded, and the unshielded beam sliced Rover's periscope off near its base. The vehicle spun in a hand-brake turn, accelerated into a full-blooded gallop, and headed Domewards as fast as its bubbles could carry it.

Back in the Dome, Tonia took charge of the MINER's memory, hooked it up to a readout unit and quick-searched its images, looking for Oddity's arrival. When she found it, she told the organizer to replay it on the main projection screen.

. . . A spear of blue flame, high against the background of stars . . . a rapidly growing shadow as the machine came in to land. Clouds of dust, rising in thick plumes in the feeble gravity.

"Competition. Let's run a sweepstake on its point of origin. I bet Pacific Trading." But it wasn't: it appeared to be very close to the variable star *U Hydrae*. "All bets off, ladies. Must have made a detour. Nothing could come direct from Hydra!"

Detour smelt of subterfuge which, combined with apparent hostility, was deeply disturbing.

The book may not have said anything about anomalous objects appearing from nowhere, but it said an awful lot about what to do if attacked. The advice boiled down to two items: defend yourself to the best of your ability, and contact higher authority. Hell informed the organizer that she was invoking emergency powers.

According to the book they should then sit back to await further instructions. But something was nagging at the back of Diamond's mind. "Hydra . . . didn't we have a problem with Hydra?"

"Yeah. Coupla weeks back, right? Problem with . . . um. One of the antennas?"

"You got it. It was having trouble getting itself aligned. I caught it reteaching its neural net where its reference stars were, and wondered why." Reference stars, by definition, don't change relative position, and the net had learned the shape long before she had started her tour of duty. "Remember? We had a big argument about it. At first I thought it must be hardware error, but in the end we tracked the problem down to an external."

"Yeah, that new bright star in Hydra."

"We decided it was a nova, and ev-

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eryone lost interest because it would have been detected Earth-side long before."

Tonia told the organizer to upload historical data from that period and display it as high-speed visuals. These showed something that their previous superficial analysis had missed: the new star in Hydra had been moving against the stellar background. The trajectory was consistent with the free-fall motion of a light object—no more than five hundred tons, probably less—at a distance of the order of mere tens of thousands of miles. The antenna's net had been watching Oddity's approach run.

The founder's face, eight feet across, stared down from the boardroom wall.

"Grace isn't going to like this," said Byrd.

"Rogan, you have an absolute talent for stating the obvious. *None* of us likes this. Does Magenta have any line on its origins?"

"Pac Trad, Jacynth, that's my bet."

"I don't want bets, I want answers! Magenta's been spending bloody billions putting spies into every major competitor! Now when we want some payoff, what do we get? Nothing!"

"Honey, I've often suspected we get little more from our advertising budget, which is twenty times what Magenta has to play with. When did you last run an appraisal?"

"You're straying off the point."

"Ha! Evasion! I thought so!"

"Jacynth, you know very well the board decided against over-frequent appraisals. The competition advertise: we advertise. End of argument."

"*Over*-frequent, yes, but you haven't—"

"Shut up, Hag's coming!"

The door revolved, and Grace Swanling stepped into the boardroom, her movements having long ago ceased to justify her name. Though she was beautiful when young, it was said. It was difficult to visualize her in either state.

"It's not Pacific Trading," said Hag.

"Magenta *got* something?"

"Magenta got nothing, dear. I called Kugashori direct."

"Can we believe—"

"On this occasion, yes. I also called Grigorchik, Hausmann, Morita-Castro, Roo, and the Antarctic Plenipotentiate. It's not them either."

Byrd thought for a moment. "Not a major ecobloc." He trusted Hag's judgment: all the big blocs had the goods on each other, that's how they kept in business. There were pressure-points, and Hag knew them all. She also knew when to call a bluff and when not to. "Small fry?"

Jacynth chuckled sourly. "Small fry put a lander into the asterbelt without anyone knowing? Loop it in from bloody *Hydra*? That much fuel would leave an audit-trail like the Nile flowing with Day-Glo!"

"We have a lander of unknown origin," said Hag. "On our patch. Our best information says it did not originate on Earth. What does my board deduce from that?"

"Our information's shit," said Jacynth.

"Not now, dear. Byrd?"

Rogan Byrd ran his fingers nervously through his thinning hair. "Grace, surely you're not suggesting—"

"If the anomaly didn't originate on

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Earth, Rogan dear, it must have originated somewhere *else*."

"You think it's *alien?*" Jacynth's voice rose to a thin shriek on the final word.

"*You* do, dear. That's why you're shit-scared. *I* say we'd better assume it could be." Dear God, why did it have to be *Pirelli*'s asteroid? "Byrd: set me up an appointment with the chief exec. Warn him it's security council material, and *very* urgent. Jacynth: tell Pirelli to put up a satellite."

"Survey or defense?"

"Um. Both. Keep the defensat on safety."

"For the moment," added Byrd.

The first pictures from the survsat were coming through. Diamond set up a relay, and cursed the seventy-minute delay in radio transmissions. However, they didn't have the analytics that SwanCorp had.

"Just think, Tonia. First contact, and we're it. You know, as a kid I always dreamed of this. It's why I ended up out here, I think." The curious movements around Oddity's base, which earlier she had seen as no more than a haze, caught her attention and she zoomed in. "Oh Jeeze, *no!* It *can't* be!"

"What's the problem, Di?"

"*It's having kids!*"

Hundreds of tiny machines swarmed around the mysterious device. "They're building things," she said, in a voice suddenly devoid of emotion.

"Building? What with?"

"Take a look. I'm going to report this *now*."

Some of the tiny machines were building. Others were digging lumps of metal from the asteroid's surface, hacking off protrusions, sucking up loose rocks. Dust swirled in thin clouds, partially veiling the activity below. Then the satellite lost contact as Oddity sank below the horizon. Close to panic, Diamond launched two more: she wanted no further breaks in surveillance.

Oddity was mining metal, manufacturing something with it.

The receiving antenna perked up, swung, nestled. SwanCorp spoke. The flow of information was now two-way. The first message confirmed that under emergency procedures the corporation would underwrite exceptional expenditure. The next ruled out Pacific Trading, Eurocom, Stateside, Oz, Byelocombine, Amazonia, or the Antarctic Plenipotentiate as Oddity's point of origin. It matched no technology profiles, and it wasn't a fake.

Oddity was to be presumed as an alien artifact, until proven otherwise. As instructed, they launched a fourth, more cumbersome, satellite to join the three that were keeping watch. This one had teeth.

The swarm of submachines around Oddity's base was more active now, growing in size, speed, and degree of organization. It was building a huge complex structure, which, as it grew, began to resemble something strangely familiar. . . . Diamond's growing suspicion was shortly confirmed. Oddity was a VNM, a Von Neumann Machine. It was building a copy of itself. Estimated time to complete that operation: forty hours.

So what? she thought. Qualitatively, the threat from two machines was little worse than that from one. The defensat

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would cope equally effectively.

No it won't. Each machine would build another copy. After 80 hours, 4 machines; after 120, 8; after 160, 16 . . . repeated doubling, a self-organized population explosion, which would continue until—

Until it was ready for whatever the machine's builders had in mind.

A single alien artifact, even if apparently hostile, was one thing. It was worth taking some risk to preserve a chance of friendly contact. An apparently hostile alien artifact that reproduced itself was quite another—a disease, an implicit army.

They waited. On Earth, hard decisions were being taken. The chief exec had all the other blocs on his back, running round in tiny circles sniveling. Hag would have used her veto, if need be, but the board had seen the logic of the situation. *Our first alien contact, and we kill it.* But it was hostile, and deadly. You don't play games with VNMs. *Kill it good, Pirelli. . . .*

"First sensible bloody decision we've had from the directorate," said Tonia. "That thing scares me stiff! You can tell it's hostile, just by its shape."

"Tonia, dear, it shot at me," Diamond pointed out.

"Yes, but it's left us alone since. What I mean is, it looks . . . well, military."

"First one they made must have cost a bundle," said Hell. "*Got* to be military."

"But all the rest are cheap as dirt," said Diamond. "Most probably commercial."

"Mercenary," said Tonia. "As long as it doesn't cost the *Earth*, I'm happy."

They were all busy now, putting the defensat on manual for rapid response. You can't fight a war with a seventy-minute delay. The simulations were running, the alignment looked good.

"Don't forget a flash cut-off on the visuals."

"That's automatic—the survsats' sensors won't let themselves be damaged."

"I was thinking of *my* sensors."

Diamond checked her board. Everything was normal, no interference from Oddity. It must know they were there, after all, it had fired at her out by MINER-8. Why didn't it *do* anything about them?

"Two minutes," said Hell. "Just coming in from the edge."

"Shoot straight, Diamond, *please*," said Tonia, close to tears.

"Fish in a barrel," said Diamond. The yellow triangle that marked Oddity's position swung towards the cross hairs, centered, locked . . .

"*Now!*" yelled Tonia. "Kill it now, Di!"

But Diamond suddenly realized *why* Oddity had been taking no further notice of them. She parked the cross hairs back in the menu bar, and locked off the defensat controls with a code only she knew.

The Dome was in uproar, everybody screaming at her. Somebody grabbed her by the hair, dragged her off the stool, threw her to the floor. She bounced in the low gravity, blood trickling from a gash over her ear. Somebody else slapped her face. Then they were wrenched away, and Tonia stood over her, flushed bright red, fists

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bunched. "For Christ's sake, Diamond, what are you *doing?*" She turned, defiant. "Let her *alone*, you idiots! This isn't going to do any good! There'll be another opportunity on the next orbit, let me *talk* to her." She turned back. "Why, Diamond, *why?*"

"We can't kill it."

Tonia stared at her in pity. "I *know* it's first contact, Di, but that thing's dangerous. We've *got* to kill it! You can't risk the whole human race just because of some misguided empathy with aliens who are obviously—"

"That's not what I mean," said Diamond. "We *can't* kill it, even if we try."

"You think it's hardened against *nukes?*"

Diamond shook her head hopelessly. "No, that's not what I think at all." She struggled to her feet, limping where her knee had hit a stanchion. "Of course we can kill *that* one, but—Tonia, help me put a call through to central directorate, my head's swimming, I can't read the board."

"Diamond Pirelli, if this is some harebrained scheme to save that bloody alien *thing*—"

"*Please*. We don't have that much time. Just over an hour from now they'll know I've locked off the satellite. The cryptos will be working overtime to crack the new access code I've given it. Then they'll destroy Oddity by remote control—which I assure you is *not* the brightest idea."

Tonia gave an elaborate shrug, looked at the others. Some stared back sullenly. A few nodded. Nobody said anything. "OK. Just be very sure you're right."

"Ask for a full meeting of the board. If they're going to overturn the kill order we'll have to convince a majority. While they're discussing it, I'll put my arguments on tape. As soon as they agree to call the meeting, we'll transmit it."

"Why risk the delay?"

"I've got to have time to get it *right*. And I want to be sure the whole board hears it. Call it a calculated risk."

While Diamond prepared her tape, the others sat in nervous groups, talking quietly, waiting for SwanCorp to respond. Some played cards. Every so often one of them would glance at the screens. As the minimum deadline for two-way transmission approached, the tension grew. Another ten minutes passed. "What are they playing at?" said Diamond in exasperation.

"Boardroom games, darling," said Tonia.

"Not *now*, surely."

"Now more than ever. Brinkmanship. A time of crisis is the time of maximum leverage."

"Christ, that explains why I hate the bastards so much. Maneuvering for personal gain at a time like—"

"Here comes your answer, Di. You up to taking over the board?"

"Never felt better. At last we—oh, *no!*"

"Now what?"

"See for yourself." She put the message on screen.

Employee D. Pirelli's corporate privileges are revoked. Employee H. Shackleton is appointed communication officer pro tem in addition to normal duties. Shackleton is to interrogate Pirelli using all necessary means to obtain

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access to defensat controls. Original orders confirmed. Destroy alien device. G. Swanling, ED.

"So much for calculated risks," said Diamond.

"All necessary means . . . they're casting you as Torquemada, Hell."

"Shit, *I* don't want the bloody job. I'm an electronicist, not an inquisitor. Why ask *me* to do their dirty work?"

Diamond looked ill. "That stupid. Old. Bitch. Used her veto to overrule the board, probably. Damn. My fault. Tactical blunder by Pirelli. I should have got someone else . . ."

"Are you all right? You're rambling."

"No, I'm thinking. Hag Swanling has reasons not to like me; she's obviously thrown a tantrum and used her veto. I won't just sit back while she makes the biggest mistake in human history. She's *got* to listen."

"Hag Swanling is one stubborn woman," said Hell. "Powerful, too. I'd say we're in trouble."

"No we bloody aren't," said Di. "Nothing that matters in comparison to that alien monstrosity out there."

"Can we block their communications?"

"With us, yes. With the defensat, no. It's got its own antenna. It won't take them long to break the code. Damn it, *think*, Pirelli . . . got it! Hell, put a transmission through. Don't say it's from me. Say I've been replaced as ordered, say anything you like to get their att—" She stopped. "No, that won't work. Oh, try it anyway, but I've got a better idea. Crazy Universe that it should come to this. I'll have to make it personal."

"Anybody in particular?"

"Yeah. Hag Swanling, who else? Personal and Private."

"*Hag Swanling?* You'd like maybe the chief exec of stateside?"

"Don't try to make it easy for yourself. Private. *Both* ends," she added. "This is personal, you don't get to hear it. But she'll listen to me all right. Put a public header on it. Tell her 'Kurbnesh.' "

"Kurbnesh?"

"Right."

"What the hell is Kurbnesh?"

"It's something the Hag and I have in common."

"That bitch's whelp Pirelli has sent a *private* message? To *me?*"

"Two-way private," said Byrd. "Quantum key distribution. Your eyes only."

"Pirelli. Pirelli's out of it, her privileges are revoked. Shackleton is in command. Tell her to obey orders and *kill that VNM!* The CE's on my back, I'm not interested in Pirelli's special pleading!"

"Grace, you've got a mutiny on your hands. Pirelli's locked everything off and Shackleton refuses to extract the code from her. Call a board meeting like she wants."

"And give in to blackmail?"

"*I'll* call the meeting. Against your advice."

"You do and I'll not only veto every decision it makes, I'll have you removed. I've got five crypto teams working flat out. Pirelli's silly code won't last more than a few hours. Stop telling me what to do, Byrd dear, and do what *I* tell *you*. Get ready to reprogram the

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defensat for remote command. I want its memory wiped first—Christ knows what they might have done to it. Hmmm . . . just in case, locate the fastest ship in the vicinity and divert it. Yes, dear, I *know* it'll take weeks to get there: *do it!* Tell them to blow the asteroid apart if they have to. Mutiny? I'll put them in court and ruin the lot of them."

It was useless to point out that she couldn't blow them to bits *and* sue. Byrd hated Grace Swanling when she was in this kind of mood. "There's a public message header. It says to tell you 'Kurbnesh.' "

Hag Swanling sat bolt upright. Usually she was good at concealing body language, but *this— How* dare *she! What makes her think that anything she says about Kurbnesh would persuade me to change my orders? That machine will be the death of us all if we leave it alone!*

But she knew that she'd have to accept the message, and listen to it, all of it, every hateful word of it—or she'd never sleep again.

Back in her suite of apartments she held the capsule as one might a small bomb, her hand shaking. Then she willed herself to become calm. You don't run a top corporation in one of the major blocs by letting personal emotion cloud your judgment. At least, not when it really matters. She tossed the capsule into the player's hopper.

A holographic image formed above it. Diamond Pirelli's young, defiant face. Hag swore, noticed the bloodstains, the lines of strain, and smiled. *Psyched herself up for confrontation. Can't take it, you can see it in her eyes. If Shackleton won't push the button, I'll have her replaced too. Whoever gave Pirelli that clout will do admirably.*

"Ms. Swanling, Grace, I know this will hurt you. It will hurt us both. But I've got to get your attention, and you've got to listen to the whole of this message. We can't argue when there's a seventy-minute delay."

You insolent little cow. As if I'd stoop to arguing.

"You can kill that VNM, one way or another. We know that. But you'll be making the biggest mistake of your life if you do."

The biggest mistake of my life, dear, was to let you within a light-year of a corporation project.

"If you're to listen rationally to what I say, we've got to clear away what's between us."

If I'm to listen rationally? Insults, now.

"What happened at Kurbnesh—it was my fault, but I didn't realize at first, and after I found out, it was too late. I didn't realize Stavro was with you. I thought he was a free agent."

Stavro, my dear, was a Greek god, and you took him from me. She remembered everything in fine detail, as if it had happened yesterday. Stavro wasn't actually Greek, he was Albanian, but his ancestors were Greek and it showed. Kurbnesh was up in the mountains, developed for the select conference trade, and she—but the tape was running ahead of her thoughts.

"Afterwards, I realized how you must have felt. I—I don't know how to say this, how to be tactful. You'll be offended. Please keep listening . . . I was young, pretty, I could have had any of a dozen beautiful young men. You were *old*. You were *ugly*, Grace Swan-

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ling. They called you 'Hag,' even then."

I'll kill her.

"You *know* that Stavro wasn't what you wanted him to be. He was pretending. He told you he loved you, but it was a lie."

"*He* did *love me!*" Hag Swanling screamed at the hologram.

"No he didn't," said Diamond's image. She had anticipated the reaction. "He was a very attractive man. He would have gone anyway . . . if not me, then some other pretty face. He was only hanging around you for the power, the money; but it wasn't enough. Stavro was just that bit too honest. He was repelled, not attracted. He couldn't face himself in the mirror any more. He told me so."

Icy silence. Diamond had left gaps. This one wasn't needed.

"Instead, you survived, to lead one of the greatest corporations on Earth. I've never been able to admit this before, even to myself, but in a way I admire you, Hag Swanling." The name had shock value; Diamond used it. "Wear the name with pride, it fits you. You don't *need* youth or beauty. You have your cunning, your strength of mind, and your character. *Nobody* pushes you around."

I'll have her brought back to Earth and I'll take her to pieces, inch by inch—

"And no alien monsters with Von Neumann Machines are going to push you around either."

"Not if I can—" *Shut up, you old fool. It's no use screeching at a hologram. Not if I can kill the bastards. Which you are currently preventing, my dear.*

"But the aliens *will* push you around, if you kill this VNM. They will push us *all* around." The image suddenly hung its head, no longer defiant. "There's more. I never thought I'd tell it to another human being. Certainly not to *you*. I didn't plan this. But—truth time. You saw me with Stavro, that evening. Going to my room. Next morning, both of us had left town. You assumed he'd gone off with me. You've hated me ever since. You'd have taken me off the project, but I'm too good at my job, the board wouldn't let you."

I have a loose tongue on my board.

"Hag—that's not how it happened. I'm an old-fashioned girl, I like to take my time, get to know people. Stavro . . . was in a hurry.

"He raped me, Hag. In my own room, on my own bed.

"Then he ran. I was so ashamed, I had no witnesses, all I wanted was to get away. I took the first flight I could get." The tears were flowing now, bright rivulets of liquid light.

"Now, I'm—I'm going to give you time to think this . . . Oh, damn. I've been deliberately brutal, and I'm sorry. But you've judged me unfairly. We're both victims. . . . Look, I'm going to stop speaking now, and put the player on pause. I want you to think of what I've said, and if you *really* want to defeat the aliens, and not just make a futile gesture . . . you can set it running again." The proud, miserable image flickered and died.

Grace Swanling stared at the space where it had been. What she was seeing, she alone knew.

"Anything happening yet?"

"There's a lot of stuff coming in.

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Funny stuff. Trying to break the code, without a shadow of a doubt."

"Tonia, is there any way we can cut them off?"

"No, what I'm monitoring is a direct transmission to the satellite."

Diamond ran her fingers through her hair. It felt greasy. If Hag regained control, she shuddered to think what would happen. They'd never work again, that was for sure. She suspected she had more than that to worry about. It all depended on the private message. She knew Hag would bite—but which way would she jump?

"*Oh*-oh. Take a look at screen four, Diamond."

"Shit. They've got it moving." She glanced at her wrist, performed a quick mental calculation. She didn't like the result. There had been more than enough time for Hag Swanling to play the message *before* the code had cracked.

The defensat's laser tilted back towards the horizon, then down towards Rockoon's surface. Hell was plotting orbits on screen two. The alignment was a bit wobbly—not surprising when everything had to be preprogrammed with a seventy-minute delay—but the VNM would be right on the spot on the next pass.

Ten minutes went by. "The power banks are charging. It's getting ready to fire, Di."

Diamond Pirelli looked at her companions. *What a waste. All because that stupid—*

"Coming into line now. There's a forty-second attack window. Opening in ten seconds."

"If I were them I'd use all of it. Short bursts."

"Yeah. Maybe they want to put everything into one shot, in case it can dodge."

"Or shoot back."

"Come *on*, damn you! Get it over with!"

The window closed. The defensat swept onwards, its power banks still fully charged. Below, Oddity continued mining Rockoon's dirty soil.

"Hell, did you compute that window right?"

Helen Shackleton glared at her. "*I* know what *I'm* doing, Tonia.

"The question is, do *they* know what *they're* doing?"

The big transport settled into proximate orbit. The asteroid's gravity was too low for it to orbit that body, so it orbited the Sun on a roughly parallel course and kept in place by occasional adjustments. When it was ready, it sent a shuttle down to pick up Diamond Pirelli. No-*g* wasn't so different from low-*g*, but it was different enough to make her feel awkward; she kept brushing against things. She was shown to a small room near the vessel's command center, where Rogan Byrd was waiting.

Byrd looked at her in silence for a moment. "The amazing Diamond Pirelli," he said. "The only employee ever to have defied Grace Swanling and survived." He shook his head through tiny arcs. "You changed her, Pirelli. I don't know how and she's not telling. She's still an ugly old cat, but you've dulled her edge, she's that much more human. Still as aggressive as ever, but less vindictive. By a whisker. Speaking of which, lucky for you, you were right."

"It was a question of thinking, instead of being panicked into doing the

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obvious."

He laughed. "*We* didn't panic, we were *pushed*. The chief exec was the one who panicked. When you defied Grace Swanling, you defied the entire stateside ecobloc. The other blocs were none too pleased, either."

Through the window she saw a long streak of blue light against the black of space. One of Oddity's babies was going home.

"When they got up to sixty-four VNMs I thought you were wrong," said Byrd. "The chief exec was on the verge of ordering in the nukes."

"It depended on how many they needed to make a viable colony. It could have been anything—but sometime they were going to stop replicating and start diversifying. It's lucky they stopped at sixty-four, though, I guess." She straightened her back imperceptibly. "Nuking them wouldn't have helped, you know."

"No, it would have made things worse. We see that now. *You* saw it then."

"That's right. It was a matter of getting inside their heads. Once you've got one VNM, you've got as many as you need—subject to finding enough raw materials. But things like Oddity can't roam the galaxy on their own. There's a mothership somewhere out in the direction of Hydra, full of the things. Has ULBOA found it?"

"No. It's below the resolution of even the Ultra Long Base Orbital Array."

"That's what I expected." She was getting off the point, and she collected her thoughts. "That thing took no notice of us. I wondered why it didn't much care what we did to it."

"It fired on you when you tried to get close."

"Yes. But it didn't send anything after me. Mindless, short-range defenses only. Why not? Easy enough to build those in as insurance. But there are considerable overheads in maintaining an intelligent long-range defense. I couldn't decide which way the aliens would jump on that. Until I asked myself what the mothership would do if we destroyed one of its toys. Expendable, replicating toys."

"It would send more," breathed Byrd.

"Right. Hydra, most appropriate, the stuff of legend . . . *cut off one head, and two more grow in its place*. Maybe ten. And if those were destroyed too—"

"Four. A hundred. Scaling up all the time until it sent a force that couldn't be destroyed."

"Precisely. VNMs are hard to beat. No need for intelligent defenses. You don't even need to know the enemy's capacity: just keep trying. Exponential beats polynomial. But we had to beat them. I thought about that. I wondered, would they just *keep* replicating, eat up the whole asteroid if we let them? I decided not. That machine was there for a reason. It wasn't just going to replicate itself indefinitely—that would be pointless.

"*We* replicate ourselves indefinitely."

"There are times when I think that's pretty pointless, too. No, don't ask me to explain that remark." Her voice faltered for a moment. "In—in any case, we *evolved* that way. These beasties were *manufactured*. They're cheap enough now, but somebody invested a lot of effort, somewhere, some time,

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making the first one. No point just making millions of machines that can't do anything except make more of themselves. No, they were going to diversify. The way you make a VNM is to build a universal constructor, a machine that can make *anything,* given the plans. Then you give it its own plans, until you've got lots of universal constructors to play with. Then you set your army to work on whatever tasks you can provide the plans for."

Byrd picked up a bag of electrolytes, sucked a few mouthfuls. "Dehydrated," he explained. "You want some?" Diamond declined, she was used to an atmosphere kept artificially dry to reduce corrosion. "You guessed it would be sending raw materials back to the mothership."

"That's what *we* were here for. Oddity was here for the same reason. But not just back to the mothership. All the way back home, to whatever planet spawned these godforsaken devils. We're the end of a pipeline, a twig on the supply tree. We've got to deal with the *source,* not just a few VNMs. You have my pets on board?"

"Yes. Seeding will take place within the next few hours. No point in wasting time."

"The VNMs are disease vectors," said Diamond. "It's no good killing them one by one. You have to get back to the source. It's how they killed off rabies at the start of the New M. Infect the foxes with an antivirus."

He laughed. "And you designed a VNM antivirus."

"Cleverer people than me designed it. I just had the idea. If you can't beat them, join them."

"Nanomachines."

"Micoscopic parasites. *Dormant* parasites, producing no symptoms. Maybe for a thousand years, no symptoms. Replicate, infest the system, but no symptoms. Until they hit a high gravitational field. The home planet, or planets. Then they go wild, eat up everything, replicate explosively. One hostile alien machine culture, gone."

Byrd sucked again at the electrolyte pack. "At first we thought you'd gone soft. Taking ludicrous risks to get the credit for first contact with aliens."

She shuddered. "Credit? For contact with things that would inflict a plague of VNMs on the Universe? I'm not *that* stupid. The beauty of it is, once the nanomachines are in the system, we can start blowing up their VNMs if they make too much of a nuisance of themselves. Sure, there'll be more, but we can buy time." She gave the electrolyte pack a wistful glance. "You haven't got anything stronger, have you? Our beer's weak as dishwater and the low-*g* still we tried to build didn't work."

"Alcohol is not permitted on SwanCorp ships," he said. He rummaged in a locker and passed her a small black bottle. "Depress the cap with your tongue and suck gently."

She sucked, coughed, sucked again. "Vodka?"

"Byelocombine's best, courtesy of Arkady Grigorchik."

She tilted her head. "Want some?"

He thought about it for a second. "I believe I do—and I thank you, Diamond, even though you are offering me my own drink." They looked out of the window at the distant, populated, alien stars.

They seemed uncomfortably close. ■

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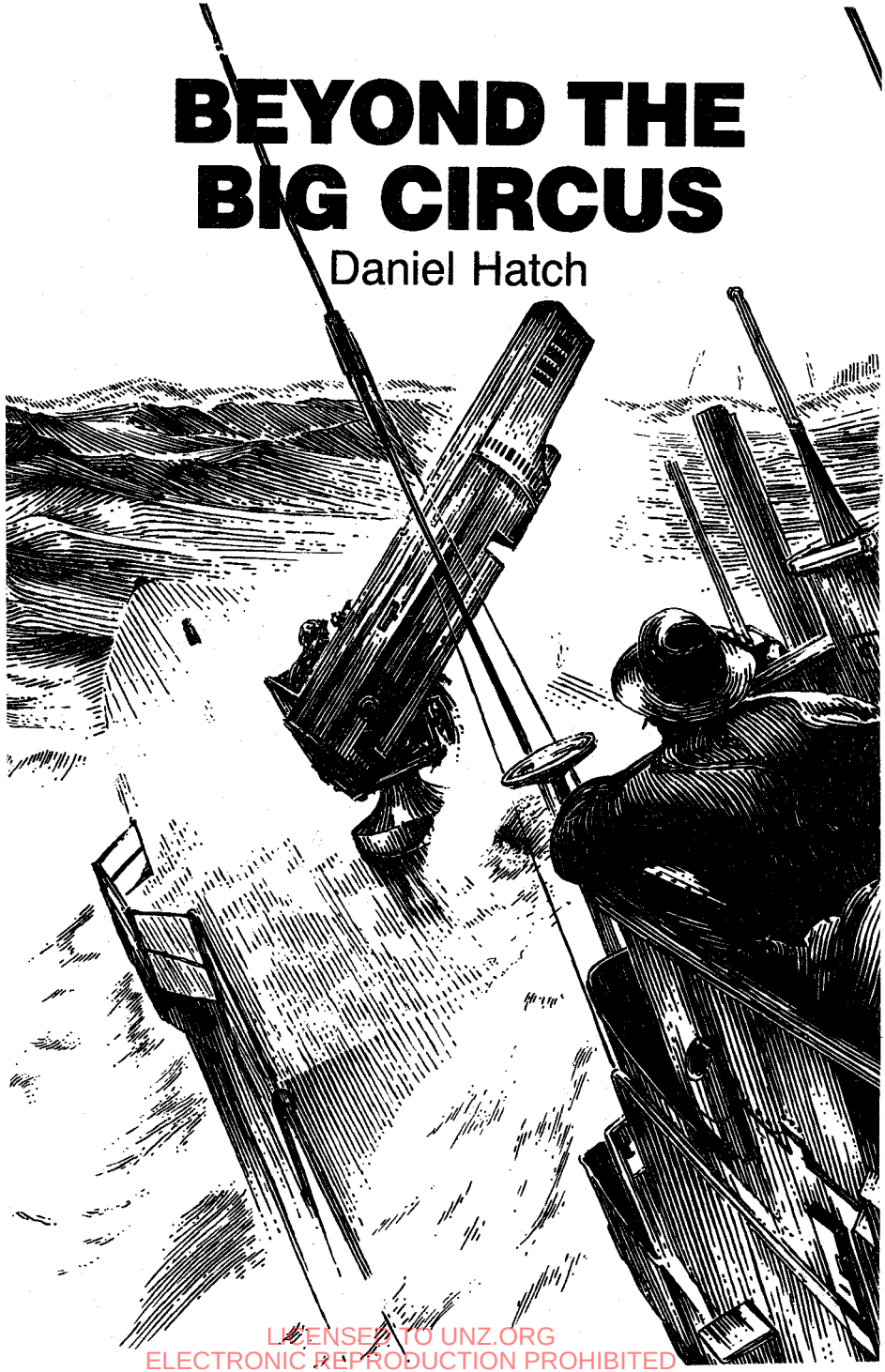
BEYOND THE BIG CIRCUS

Daniel Hatch



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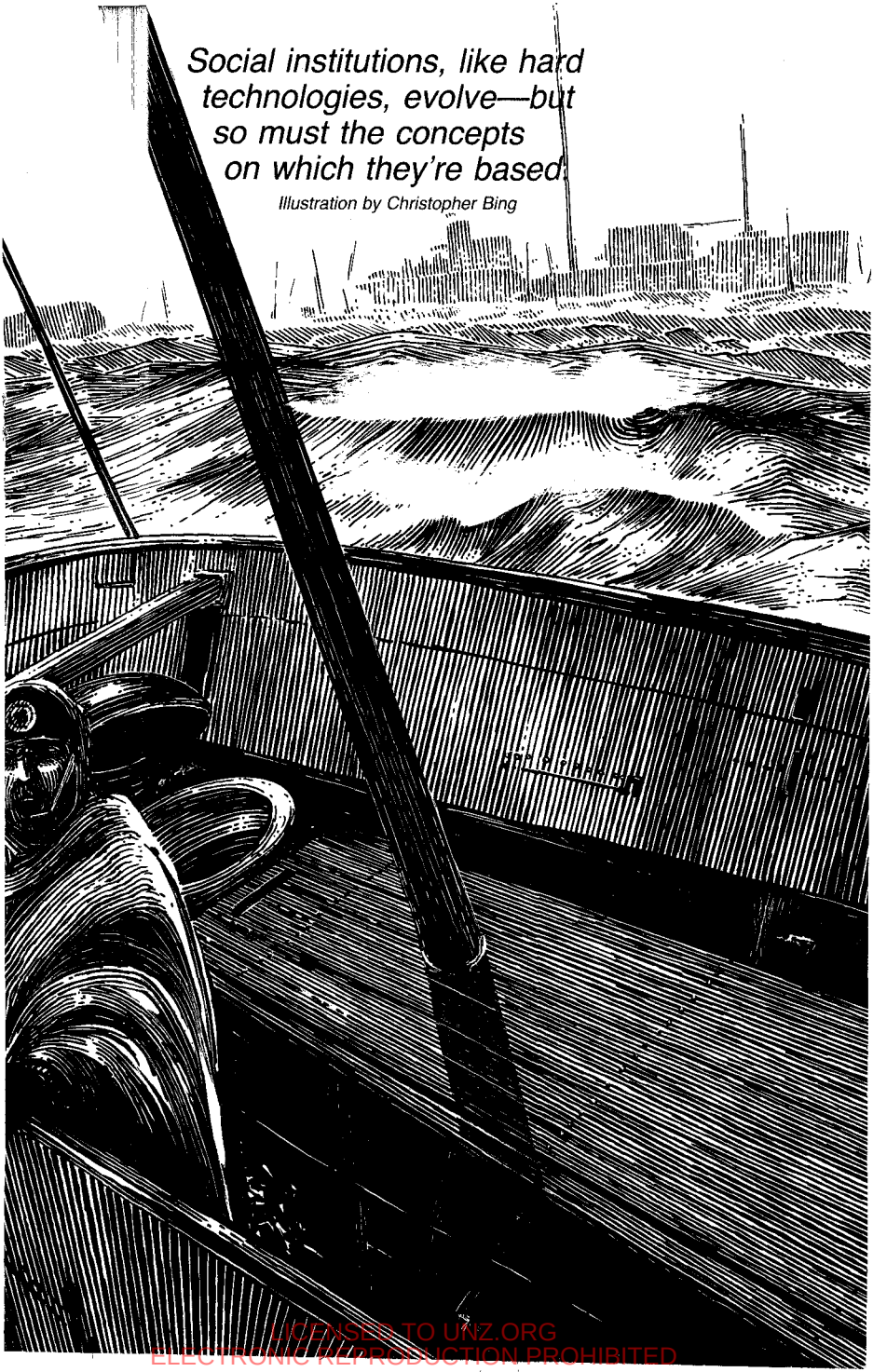
Social institutions, like hard technologies, evolve—but so must the concepts on which they're based.

Illustration by Christopher Bing



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I'm the first to admit that I'm not a man of many strong loyalties.

The times are against it.

There was once a period of history when you could give your allegiance to the great nation-states, but they've been dead and buried for centuries. And the World Food Authority and the Colonial Trust, the great bureaucracies that took their place, never commanded much more than obedience—never true loyalty.

It's been twenty years since they held power over the affairs of the world and in that time the Circus Maximus hasn't been able to rekindle feelings of patriotism. It hasn't really tried. Without a flag or an anthem, there's little to nourish the soul of the loyalist beyond slogans like Equality, Freedom, and Democracy.

Granted, the Big Circus does what it can to make those things a reality. In the end, however, it's more of an agreement among the survivors of the WFA and the Trust to do the greatest good for the greatest number than it is a true state. The Circus is just too big and too vague to foster the grand loyalties of long ago.

But when you're on a ship in the middle of bad weather on the Bering Sea, you find small ones that serve just as well among the men and women you depend on to survive.

Especially when you're facing a fleet of Asian fishing boats that have found themselves too far east.

The horizon rose slowly and fell quickly as I looked out over the bow of the *Polar Star* at the Asian fishing fleet. A fountain of spray exploded before me as the fleet dipped in and out of sight with the motion of the sea.

Two dozen vessels labored against the weather out there—an old factory ship with a power broadcasting antenna, a bunch of slave boats that depended on that power to recharge their batteries, and a rusty trawler.

From where I sat in the spotter's seat of the icebreaker's 130-millimeter gun, they didn't look very formidable. They hardly seemed worth the attention of the Alaskan Coast Guard and its superiors in the Big Circus—even if they were on the wrong side of the Bering.

"Hey, Chief Brume, what's going on up there?"

It was Sweeny, the red-haired gunner from Matanuska.

"Just waves," I said.

Sweeny was a pain in the neck. A few minutes earlier, when I showed up at the gun mount late for general quarters, Sweeny started complaining.

"Jeez, Chief, where've you been? I was getting worried about you. I mean, what if we had to start shooting or something? They want to know if we're manned and ready up on the bridge."

When the kid finished babbling, I chewed him out in return. Not only was Sweeny ten years younger than I am, but he'd only been aboard the *Polar Star* for a month. He was in no position to be questioning his seniors like that—even in the highly democratic society aboard a coast guard vessel.

Of course the problem wasn't just Sweeny, but the whole crew of slackers and malingerers. He was just getting his share of it.

He was like the rest of them, though—a bunch of landlocked sailors who had drawn too many advances

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against their wage accounts. The paymaster had scraped them out of the barracks and the bars just before we put to sea—leaving the few veterans like me to do the dirty job of turning them into real sailors.

I knew what kind of men and women they were. I'd been just like them once myself.

"We don't even have the high-pressure air on line yet, Sweeny," I'd told him. "You don't need me here until it is. And you sure don't need to worry about shooting anything. That's just a few fishermen out there—not some ghost fleet from the Food Wars. Believe me, we're not going to be firing this thing today."

As it turned out, however, I was wrong.

The fleet had been detected north of the Aleutians by the orbital stations of the Circus Maximus. The satellites used to be the battle stations of the late nation-states and then, in their turn, the spy platforms of the World Food Authority and the Colonial Trust.

But in the years since the Circus had forced the political leaders of the Trust offplanet, they'd been put to more benign use—monitoring shipping and air traffic to maintain safety.

The Circus claimed it was part of the mission of maintaining the "common welfare of the Great Circle of humanity." Some people might have believed that, but I was more skeptical. Oh, I'm sure the satellites weren't being used to spy on us anymore—but I didn't believe the Circus was any more committed to my common welfare than the bureaucratic empires it had replaced.

Sure life was sweet enough under the Big Circus. Everyone had plenty to eat without having to work for it. And if you wanted more than a bare minimum of luxuries, there were plenty of jobs to be had and the pay was good too. Of course, that's all because the Food Authority finally made sure there was enough food and the Trust had shipped half the workforce off the planet. But despite all that, the Circus was still a government—and I figured it was only really interested in itself.

They'd found the fleet out of place after a heavy storm center swept out of Siberia. When maritime officials in Alaska were unable to contact the fishermen by radio, they got worried about their safety. And animosities left over from the Food Wars about fishing on the wrong side of the pond were still strong in some of the villages up here in the north.

So they sent the coast guard, which meant the icebreaker *Polar Star* because it was the nearest vessel to the fleet—and because the weather north of the Aleutians made aerial reconnaisance if not impossible, then certainly foolhardy.

The *Star* had pounded against the seas all night long, except for occasional breaks of smoother sailing when our tokamak reactor went off the line or the smaller laser fusion reactor that powered it shut down.

Now that the fleet was before us, good old Captain Haywood was ready to go after them like Trustbusters, guns loaded and battle stations manned and ready.

But I knew what most of those fishermen must have felt like. They weren't

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worried about getting pinched for poaching in Alaskan waters. They were more concerned with keeping something in their heaving bellies than putting something into the hold of the big factory ship. Their master might have some hidden motive for sailing too far east, but the fishermen were just trying to survive.

My father had done the same thing for most of his life and on more than one occasion he'd found himself on the wrong side of the dateline. I'd been out with him in these waters too, so I knew what the crews of the slave boats had to be experiencing. Even on the *Polar Star*, the Bering was no summer sailing party.

"What's happening, Rosey?" I called over my headset.

"We're still calling the factory ship on VHF, Jonnie," answered Lieutenant Cristina Rosario, the weapons officer, from her post on the flying bridge. "There's no answer."

"This is Captain Haywood," came a voice over the phones. "Stand by in the 130-millimeter mount to load and fire a warning round."

"What?" I asked without keying my microphone.

I couldn't believe what I was hearing. Was the captain serious?

"I don't trust these fellows, Lieutenant," Haywood said. "They shouldn't be over here and they know it. The last time an Asian fishing fleet was found in these waters, the Alaskan ports launched a swarm of boats at them. They ended up with a sea-going riot—fifteen dead, dozens injured, and three boats sunk. And that was only four years ago. Unless they answer my hail, I'm going to put one across the factory ship's bow."

"Yes, sir," Rosey answered.

"Aye, aye, sir," I said.

But a sick feeling in the pit of my stomach told me that this was not a good idea.

Within a few minutes, the *Star* reached the outer edges of the fishing fleet. Even at a distance, I could see the dour faces of the slave-boat crews as they slipped by to port and starboard. Our ship slowed as we matched course and speed with the factory ship.

I looked around briefly, trying to locate the other large vessel—the trawler. I rotated the mount slightly to give myself a better look when it suddenly came into view, only a few thousand meters to starboard, blasting four times on its ship's whistle.

The warning came from all the phones at once. The trawler was backing down on the icebreaker.

Under the rules of the road, the traffic law of the high seas, the *Star* was obligated to give way to the trawler. But in point of fact, the maneuver was meant as a challenge. The trawler's master was trying to embarrass the coast guard vessel in front of the fleet. If we backed down, it would show we weren't serious.

"Keep it steady," Captain Haywood warned over the phones. "Stand by to fire a warning shot."

Rosey repeated the order and I rotated towards the trawler. I ordered the fire control computer to take a bearing on the vessel, then allowed it to aim the gun mount. But I kept control of the gun barrel itself, one eye to the gun

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sight and a hand on the wheels, to keep the shot clear of the other ship.

The trawler grew closer and closer, the grey water churning into green and white at its stern.

When it was only five hundred meters away, Haywood gave the order.

"Fire," repeated Rosey.

I pulled the trigger.

But in the next moment, two things happened.

First, the trawler slowed to a stop. And second, all the power on the *Star* faded as once again the dual fusion reactors that drove the vessel lost their balance. The mount froze up and stopped tracking the trawler.

The ship rolled sickly as it wallowed in the steel grey seas. Wind whipped the spray past the bow. I looked up at the trawler as it climbed a long swell that broke between us.

Then the power came back on, the other ship rolled into view, and the big gun went off with a blast of flame and smoke and a boom that knocked loose ceiling panels, screws, coffee cups, and paint cans throughout the ship.

But the damage to the trawler was even worse.

What was supposed to have been a shot over the stern had dipped at the last minute and taken out one of the large fishing masts, which now hung alongside the ship, caught on its rigging. Members of the crew rushed to cut it away before it fouled the trawler's screws, pausing to shake their fists at the *Polar Star*.

"Whooeeeeee!" cried Sweeny. He had opened the outer door of the mount after the smoke cleared and stuck his head out to watch.

At least someone was happy, I thought, as I imagined trying to explain the mistake to Captain Haywood. Fortunately, I never got the chance.

I did have to listen, however, to a few choice remarks from Commander Maggie Thorsenn, the *Polar Star*'s executive officer. They came after we put a boat over the side to get a closer look at the factory ship.

"Nice shooting, Brume," she said as she stepped off the Jacob's ladder into the whaleboat with the rest of the boarding party. "You certainly got everyone's attention."

Maggie was a short woman in her early forties with tight brown curls framing a round face, and piercing bright eyes. She was also a pushy officer who was never satisfied with anything I did. We didn't get along very well, but she was still better than Captain Haywood. The skipper of the icebreaker was living proof that some people can get anyone to sign an officer's petition.

They were both from a different generation than me. They'd grown up when the Colonial Trust still ran things and they still had the old attitudes about authority and power. Maggie was the better of the two.

Haywood had actually been a junior officer for a couple of years before the end of the Trust. He still thought that made him better than the rest of us, and twenty years of petitions, elected officers, majority vetos, and all the other trappings of the Circus Maximus hadn't changed that.

Maggie also had her shortcomings, but she'd joined the service under the

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new regime. And being a woman, she was more sensitive to the egalitarian spirit of the times.

That didn't stop either of them from talking about life in the "Old Guard." And we'd all learned to be sailors from men and women who'd been a part of that Old Guard.

"The fleet stopped, didn't it?" I replied.

Indeed it had, with the slave boats huddling in the lee of the factory ship and the trawler astern of them, all were keeping station with us in the gusty winds of the Bering Sea.

I gunned the engine on the whaleboat and climbed up the swell as we pulled away from the icebreaker.

"Tell me, Brume, why haven't you filed your petition for lieutenant yet?" Maggie asked—and not for the first time. "You can't have any trouble getting all the signatures you need. And you're past due—so what's holding you up?"

I just shrugged. "I guess I have trouble studying for exams."

"Trouble, my foot. You're smarter than that—despite today's excitement. You're just having too much fun being a sailor without responsibility. Someday, though, you'll wish you'd petitioned for rank—someday when it's too late."

I just ignored her. My career goals did not include putting gold braid on my cap and telling my buddies what to do. I was in the coast guard for the seniority. Once my twenty years were up, I was going to cash in my service bonds and open up a cash restaurant so I wouldn't have to eat in the cafeterias or live in a retiree-dorm. Life in the Big Circus was not meant to be a challenge. It was meant to be enjoyed. Most of the big challenges here on Earth had been met long ago.

And that was at the core of the problem for Maggie and for Captain Haywood. Under the old rules, there were ways to make people do what you wanted them to do. Discipline was imposed from above and wasn't left to the individual. Punishment was the rule. It was barely better than the days of wooden ships when orders were enforced by the threat of the lash. Or the way life was under the WFA, when disobedience could mean starvation. Even under the Trust, you ran the risk of becoming an involuntary colonist.

But without those threats, there was little you could do to coerce people into going along with your orders. Oh, they'd give way for the little ones, the duty rosters, the cleaning details, the dirty little jobs that could make life miserable but that were absolutely necessary. But people did those because they recognized the necessity.

When it came to the big things—like becoming an officer—they couldn't use threats or force. They had to come up with alternatives. Moral suasion. Appeal to the intellect. Enlightened self-interest.

Maggie tried to use guilt.

I tried to resist.

We crossed the three thousand meters between the ships quickly, climbing up one steep wave and sliding down the next. I pulled the whaleboat alongside the rust-streaked factory ship and a deckhand tossed us a line from above. The boat crew pulled down a mooring line to hold us fast to the bigger vessel. A moment later, a ladder clattered down

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from the ship's main deck.

The boarding party climbed the ladder, two seamen armed with automatic rifles in the lead, then Commander Thorsenn, then me and two more seamen. We were met by an officer and a deckhand who led us to the wardroom.

The captain of the factory ship and the commander of the fishing fleet was an aging Philippine master, First Officer Aquilio Viernes, who looked like he had served aboard the WFA ships of the last century. He said nothing throughout the meeting, but sat with an unmoving frown fixed on his face. His first mate, Takio Onikawa, a young Japanese officer, did all the talking.

"We were caught in an electrical storm three days ago," Onikawa said. "A lightning bolt struck our power antenna and crossed over into the bridge. There was a fire and our navigation and communication equipment were damaged. We have been trying to hold the fleet together and work our way back to the south, but the weather and the damage have kept us from our goal."

Thorsenn nodded as he explained the repair efforts and the problems with the small slave boats in this weather.

"This kind of weather is the only kind of weather you ever get north of the Aleutians," she said. "I don't see what makes this trip any different from your regular fishing run. What about your friend on the trawler? Can't he get a sat-nav fix?"

"The trawler is not well-equipped," Onikawa said. He never cracked a smile, despite the transparency of his story. Viernes turned his eyes toward his mate, but not his head. "Its master is an Armenian captain with a crew of mixed states and it is only by the graciousness of First Officer Viernes that it is allowed to accompany us."

Maggie sighed skeptically.

"Brume, you go take a look at the bridge and see what kind of damage you find."

"Aye, aye," I said.

The armed escort and I joined officers and deckhands of the factory ship and threaded our way along the corridors and up the ladders of the vessel to the bridge. By the time we got there, I thought I was going to gag on the smell of fish. It reminded me of the reason I had joined the coast guard in the first place and escaped the fisherman's life that my father had led for too many years.

I was grateful for the fresh wind blowing through the factory ship's pilot house. It helped clear my head and blew the oily smell out of my coat. I made a quick examination of the scorched bulkheads and burnt decking where the lightning had hit, Then I ordered my escort to return to the wardroom by way of the weather decks.

The seamen slung their rifles as I took the lead and we worked our way down the rain-soaked and spray-splashed ladders to the main deck and the whaleboat.

Up ahead, I saw another group of sailors on the main deck—several small Asian fishermen surrounding a big bear of an officer with a black short-visored cap, and a heavy black beard, who waved his arms excitedly. Before I had time to think about it, we were in the middle of them.

The oversized officer glared at the sight of the coast guard uniforms.

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"You! Why did you shoot Herkalian's ship?" he yelled at us. He waved his arms with more vigor and his face reddened. "Why did you shoot my poor little trawler?"

I wondered if he could have known that I'd pulled the trigger, but decided it was just my own dumb luck that had brought us together. Then he lunged at me and grabbed me around the shoulders.

"Why did you do that?" Herkalian yelled, squeezing tightly. I felt my face burn as the air was pushed out of me. I struggled, but he lifted me off the deck and pinned my arms to my chest.

For a brief sick moment, I imagined myself tossed over the side into the arctic waters. I struggled, but that only made it worse. Each time I let the air out of my lungs, he squeezed tighter. The edges of my vision started to fade.

Then the fishermen and the boarding party plucked and grabbed at Herkalian's arms and pulled the two of us apart.

A door opened a few meters away and Maggie Thorsenn stepped out onto the main deck with the rest of the boarding party. They snapped their weapons forward and aimed straight at the fishermen. Herkalian growled, but his men held him back.

"Brume, what kind of trouble are you causing now?" she asked. She stepped aside to allow Herkalian's party pull him into the passageway. I just kept my mouth shut as we climbed down the ladder into the whaleboat.

On the trip back to the icebreaker, she asked me for my report.

"Did you see any damaged equipment?"

"No. Just the deck and bulkheads," I said.

"That's what I figured. What do you think? Are they on the level?"

"Not even close," I said. "They've probably got their sat-nav computer and radios stashed below decks somewhere. They know where they are. And we know why. Poaching has been common in these waters for a couple of hundred years. They quit for a while after the Big Circus busted up the Trust and reorganized the Pacific fishing grounds, but in the last few years, they've started coming back. Too many boats on the Asian side of the ocean."

"You're not as dumb as you act, Brume," Maggie said. "But you still only know half of it. What do you think we should do?"

"Take them into New Egg Harbor and bring them before the magistrate. He'll fine them or put them on sanctions, most likely."

"That's what Haywood thinks, too. Except you're both wrong. That's the worst thing we could do."

"Why?" I asked, but she wouldn't give an explanation. She just kept quiet all the way back to the *Star*. I thanked heaven for small favors.

Two hours later, Captain Haywood ordered the fishing fleet to follow him into New Egg Harbor in the Aleutians.

It was called Dutch Harbor before the WFA relocated a few thousand families from southern Jersey there as part of its fisheries program. On the far edge of town you could still find several hundred circles of rust from World War II oil drums, the wreckage of combat helicopters from the Pacific War, and a gen-

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eration of refuse left over from the Food Authority. The Arctic cold preserved it all without prejudice.

The Aleutians have the worst weather on the entire planet—even with the lingering aftereffects of the greenhouse. It rains there all but thirty days a year. The warm water currents coming up the coast of Asia collide with the cold waters of the Bering to produce constant wind and storm. Trees do not grow on those islands.

So I was surprised and delighted to see the Sun appear briefly as the ship slid from mountainous seas into the glassy calm of the harbor. It broke through the gap between sea and sky to the southwest, spilling gold across the water. It cast a green glow on the sides of the volcano to the north and turned the bottoms of the grey clouds ochre.

For one short moment the world was transformed, filled with color and detail and life—and then it was gone and everything turned dark and slatey.

By the time the ship was moored and the water and power lines connected, the early Arctic night had settled in.

I showered, shaved, and headed for the gangway to take a look at the town. Halfway down the pier I spotted Charlie Altunata, my top bosun, walking the long canyon between the icebreaker and the Asian factory ship. I hurried to catch up.

"Nice shooting today, Chief," Charlie said, showing a gap-toothed grin. He claimed he'd lost his front tooth playing hockey against the Canadian teams, but the truth was he'd run into a door in rough seas. I winced and told him of my encounter earlier in the day with Maggie Thorsenn.

"Why does she talk to me like that, Charlie? I try to do the right thing. I just don't want to be an officer."

"I think she's got a thing for you," he said. "She thinks she can change you. It's the worst thing a woman can do to a man, you know."

"Tell me about it," I said. I stopped as we reached the main street of the village. Several large buildings ran along either side of the wide truck path—stores, a restaurant, the Fisherman's Union Hall, the Inuit Center, and the town offices.

"Listen, Charlie," I said, "speaking of doing the right thing—I've got a bad feeling about those fishermen. Take a look around town and see what you can see, then meet me at The Whale's Belly when you're done."

"Sure, Chief," Charlie said, as he hurried on towards the union hall. I took off in the other direction, towards a hot meal that didn't come from the bottom of the ration bucket.

I found Maggie sitting at a table in The Whale's Belly—the only cash restaurant for a thousand kilometers. She was talking to an old man with pince-nez glasses and a bushy moustache when she spotted me and called me over. I found the waitress, ordered a plateful of king crab legs, then approached Thorsenn's table.

"Have a seat, Chief," she said. "Captain Haywood is out looking for the magistrate. Unfortunately, the magistrate isn't home and his wife is going to keep him busy for a couple of hours with some home cooking."

"At least those are my wife's instructions," the old man said.

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"Chief, this is Magistrate Donaldson. Magistrate, my chief bosun, Jonathon Brume." Donaldson rose briefly to shake my hand.

"But he's going to find me eventually, Maggie," the magistrate said. "What are you going to do then?"

"Maybe by then we can find some way of talking him out of calling in the paracops."

That got my attention.

The paracops were the main reason I didn't really trust the Big Circus. If they were serious about democracy, they would have gotten rid of the Colonial Trust's private corps of storm troopers a long time ago. I'd seen what could happen when the cops decided that public order was being threatened—heads cracked, buildings burned, and whole communities relocated across a continent. And the thing that frightened me most was that they seemed to think public order was threatened a lot more easily than most of us in public.

I mean, there hadn't been any riots or demonstrations down in Ketchikan before the cops landed.

"I agree, Maggie. I don't want to see the paracops come in here and crack down on my people," Donaldson said. "And if what you say is true, even worse things could happen. But how do you convince that bald-headed chicken plucker of a captain of yours that he's up to no good?"

"Did I come in the middle of something?" I asked. "I thought the whole idea was to bring the fleet in. You never did explain why that wasn't part of your plan."

"It's politics, Brume," the Commander said. "Big Circus politics. The paracops have been staging too many landings up at this end of the Pacific. Ketchikan a few years ago, the Pribilofs last year. They're jumping in at the tiniest excuse, but they're just serving a bigger interest."

"Who's that?" I asked.

She looked around cautiously, as if afraid to be overheard, then said: "Public Works."

I stared at her in bewilderment for a moment until Donaldson came to my rescue.

"You see, son, the Public Works Corps has been itching for years to put a dam across the Bering Straits like the one they put in Gibraltar. To generate power, influence weather, exercise control over natural resources. But first, they have to move out the fishermen who would object to the plan."

"It's typical empire-building," said Maggie. "By the time they're through, they'll have the whole world tied up tighter than a tuna tin."

"That wouldn't help the fishing much," I said.

"Not a bit," said the magistrate. "It would mean the end of the fishing communities all around the Bering Sea—maybe the end for Kodiak and on east. You saw what happened to the Med when Public Works got through. Venice is still pumping the water out and the Pyramids will never be the same. It would change the whole balance of winds and currents and do who knows what kind of damage to the ecology."

"The Big Circus is being run by the clowns," Maggie said. "I told Haywood what's going on and he wouldn't listen to me, the patronizing jackass.

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He's going to write up Viernes for poaching and bring him and his fleet before the magistrate and keep them here for the hearing. That should give the local fishermen enough time to get really worked up about the charges and start making enough trouble to bring in the paracops. He's even threatening to call them in himself."

"Can't you veto him on this?" I asked.

She shook her head. "Command prerogative," she said. "There are limits even to Circus rules."

"Which leaves us without any viable options," the magistrate said. "No matter how long I stay away from home."

"The problem is that no one wants to take responsibility anymore," Maggie said.

"That's not it," I said.

Maggie and Magistrate Donaldson both looked at me in surprise. I don't think Maggie expected me to say anything, just listen. She stared at me for a long time without blinking. The magistrate took off his glasses and began polishing them.

"You know, they get these things to stick to my nose," he said. "But they can't figure out how to keep them from getting dirty."

"That's not it?" Maggie echoed. "Then what is the problem, Brume?"

"The problem is there's just too much power. The paracops, Public Works—even the *Polar Star*. The ship carries two fusion reactors, for goodness sakes. And a two-hundred-year-old artillery piece!

"The Big Circus tries to pretend that it's part of a new stage of history. Maybe so, but the truth is that we've inherited all of the machinery of the old bureaucratic world-states. It's not the power, it's the way you're willing to use it. The paracops and Public Works are just as bad as the Food Authority and the Trust. Even the coast guard still has to get its way by brute force. We fired on that trawler without a second thought. How does that fit in with equality, freedom and democracy?"

"Why *do* you carry that gun instead of a laser cannon?" Donaldson asked.

"It's to blast away at icebergs, Judge," I said. "Lasers take too long and suck up too much power to use them to melt the stuff. Anyway, responsibility's got nothing to do with it. It's just selfishness and greed. And as long as the machinery of power is lying around, people are going to use it. Good people, bad people, responsible people, irresponsible people. And no matter what they use it for, the people at the other end of the machinery are going to get hurt."

"Brume, anyone who can see that has no business staying below decks. That's why I can't believe you don't want to be an officer. And if you're so damned smart, why don't you think of something?"

"Me?" I said with surprise. "I'm just along for the boat ride. They don't ask you to come up with ideas until you've been elected. And I'm still not petitioning for office."

"I know," said the executive officer. "That's your problem."

My face grew hot. "For crying out loud, Maggie, don't you ever let up?"

"Is she picking on you, son?" Donaldson asked. "Sometimes she sounds

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just like my wife. She's always nagging me to do more with my life, too. As if practicing law for four decades under two world governments isn't enough. I think she's just worried that I may be enjoying myself."

"I'm serious, Judge," Maggie said. "Brume's only part of the problem, but you know what I mean. The Circus makes life too easy. You feed them, give them clothing and shelter, all for nothing, and you get nothing in return. No initiative, no ambition—and no responsibility. Why should he stick his neck out?"

"Yeah," I said. "Why should I stick my neck out?"

"Well, there's history, for one thing," Donaldson said. "You may not think of it that way, but you're a part of history. And you may not think you play a very big part, but tonight, you could be involved in a crucial bit of history for the people on this island. It may not be a very nice place to live, but these people have been here for four generations. They like it here. When the Circus came to power, the ones who didn't like it left. But we both know that if the paracops land here tomorrow, that will all come to an end. Don't we, Jonathon?"

I just nodded my head and frowned.

Then Charlie Altunata arrived.

"Hey Chief, you'd better come quick," he said. "There's trouble cooking down at the Union Hall."

Maggie Thorsenn's face turned sour. I cursed and jumped to my feet. The waitress arrived with my dinner and I paused briefly to throw a ten-unit piece on the table. Magistrate Donaldson's eye grew wide at the plate of crab legs placed before him.

"Enjoy yourself, Judge," I said as I headed for the door.

"I looked around like you said, Chief. Most of the town folk were at the Inuit Center, playing darts and watching the satellite. But over at Union Hall, the whole Asian fleet is in. Everybody from the boats and the trawler and factory ship are there, drinking, talking too loud and too fast. The bartender said the locals all left when they came in. He said he wanted to close down, but he was afraid to."

We crunched down the snowy street towards the Union Hall as Maggie Thorsenn came out of the restaurant behind us. Then light and noise spilled from the hall as the fishermen, Herkalian in the lead, poured out. They sounded angry.

"Come on with me," I told Charlie. "I've got an idea." We raced down to the docks ahead of them as fast as we could, the cold air stinging my cheeks. I stopped at the fire plug at the edge of the pier, pulled out the hose, and starting turning the valve. If I was lucky, it wouldn't be frozen up.

I was in luck. The hose jumped and jerked and grew hard and taut, looking like some icy boa constrictor. I motioned to Charlie to stand back, then set the nozzle to spray a fine mist, which I directed across the end of the pier and the roadway in front of it. In the frigid air, the water started to freeze almost as quickly as it hit the pavement.

When I was done, I shut off the hose and handed it to Charlie. Then I turned to face the mob that was approaching from the town.

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When they got as far as my ice patch, I stepped out into the middle of the pier, put up my hands and yelled at them to halt.

They showed no signs of slowing at first, and I was afraid I was going to be overrun. But Herkalian, a step ahead of the rest, stopped abruptly, and with him the front ranks of the mob.

"There's still time to go back to your boats quietly." I said, raising my voice to be heard over the disgruntled murmuring of the fishermen.

They jeered at me, shouting back epithets in Korean and Chinese that I couldn't decipher, but no one moved past the heavy anchor of Herkalian. The trawler's master just looked me up and down silently for a moment.

"Why don't you let our ships go?" he asked finally.

"Why don't you fish on your own side of the ocean?" I responded.

"Our side, your side, who owns the ocean? Not you. Not your coast guard. Not these fishermen. Not me. The ocean is free. We fish where the fish are. This is a democracy now; the Circus Maximus for the whole world. Who says you can tell us where to fish?"

"Look," I said. "I don't want to tell you where to fish. I just want you all to take your boats and go home. But you can't do it by starting a lot of trouble. Tell your mates to calm down, go back to the Union Hall and we'll settle it in the morning."

"In the morning, we will be gone," Herkalian said angrily. "We leave now—when we want." He made a start towards me and the pier, putting a big foot down on the ice patch. I watched it go out from under him, his eyes widening in surprise. He hit the ground with a thud.

The fishermen in back, who could not see exactly what had happened, grew agitated at the sight of their leader taking a fall. They shouted loudly and pushed forward. Those in front, who had seen, were pressed against Herkalian and unable to help him to his feet.

The confusion grew and with it the agitation, until I found myself backing up along the pier. In a moment, one of the Asian fishermen slipped and fell, then another. That set off the rest of them, who surged forward in a panic.

I was about to be mobbed when I heard Charlie yell from behind. Then a tongue of hard white water lashed out across the pier as he opened the nozzle of the fire hose and let it rip. Charlie aimed low, knocking most of the fishermen in the front of the mob off their feet. The hose bucked and the nozzle kicked and a blast of water hit the back of my knees.

I went down on my face and slid forward, coming to a stop at Herkalian's wide back. The fisherman scrambled around and looked me in the face with a terrible glare, then the fire hose passed our way once again, soaking us both to the skin.

Mercifully, Charlie turned the water off after that.

The mob, now dripping wet and starting to freeze, had lost all its fire. Its members milled around, moaned helplessly, then retreated up the street toward Union Hall.

Charlie secured the hose and came to my aid. He helped me to my feet, pulled off his coat, and threw it over my shaking shoulders.

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"That was a fine demonstration, Chief," came the clear, nasal voice of Captain Haywood, cutting through the night. "That makes it twice in one day."

"Three times if you count the factory ship," said Maggie Thorsenn, who stood by his side at the end of the pier.

"Well, no matter how many times he's gotten in trouble, it's too many. And it's too many times for these fishermen. I don't need to see any more to make up my mind. I'm calling in the paracops immediately. We'll see if these fellows are quite so rowdy once they arrive."

I shivered and quaked mightily as my wet clothes sucked the heat from me. I just looked at the two officers and grew angry. Neither one of them knew what they were doing—and they were both blaming me for it.

A few minutes later, I was in the wardroom, wearing dry clothes and toweling my hair as Charlie drew a cup of coffee from the urn.

"You know, Charlie, the idea is supposed to be that you do your job every day, put in your twenty years, and retire. You count on your seniority credits to get your name at the top of a petition for a new store or a nice house up the Matanuska. You can even open a cash restaurant or sign on with the local government boards. Nobody is supposed to give you a hard time if that's all you want."

"I know, Chief," Charlie said. "I know. It's just that you're different. The lady knows that—and so do you and I. You've got what it takes to be one of them. I don't. Neither does most of the crew. Why, I'll bet you could even figure out a way to give Maggie what she wants if you put your mind to it. You never had trouble figuring out the angles, did you?"

"She says I'm not responsible," I said. "I am too responsible. I'm just not responsible for her decisions. I'm responsible in my own way and for my own reasons."

I drank my coffee and rubbed my face.

It wasn't responsibility that was the problem, I realized. It was loyalty—and where you could put it.

Maggie seemed to think mine should belong with the Circus Maximus. But she wouldn't explain why. And I'm not sure she knew why.

She certainly didn't have a very strong idea of what that even meant. Her own loyalties did not seem so clear cut. Did she think we should obey whatever the Circus told us to do? Apparently not if it meant letting the paracops come in and disrupt life in New Egg Harbor. Or if it meant letting Public Works build a dam across the Bering Straits.

No, the Big Circus was too big. And despite all it did to make equality and democracy more than just slogans, it didn't quite live up to its own standards.

The Circus was supposed to be all-encompassing, all-embracing. Everyone belonged, no one was left out.

But the truth was that there were plenty of people left out, people who lived beyond its protection, up here on the edge of the world. The fishermen in their slave boats. Herkalian and Viernes and Onikawa. The people of New Egg Harbor. And the sailors of the *Polar Star*.

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Despite the best efforts of the Circus, the world was still split between the powerful and the powerless. Maggie wanted me to become one of the powerful—petition for the gold braid and join the elite. But she couldn't see that she was no different from the paracops or Public Works or even Captain Haywood.

The powerful might have lost some of their power with the fall of the great bureaucracies. And the powerless might be better off under the Big Circus. But I knew where my loyalties lay.

"You know, Charlie," I said, "what she really wants is to get those fishermen out of here before they go up in front of the magistrate. I'll tell you what I would do. . . ."

And the next day we went ahead and did it.

We started early in the morning—before the Sun came up. I roused Sweeny out of his bunk and sent him up to the mount. I told him that this was his chance to redeem himself.

I called Rosey and had her round up some of the girls on the crew—the good looking ones who knew how to toss their heads just the right way to get a man in trouble without getting themselves in it, too.

Then I went looking for Maggie. I found her on the bridge, wide awake from the night before, drinking up all the coffee she could find.

I told her the plan. It was going to be up to her to keep Haywood busy while we put it into action. Then we hit the village.

Charlie and the deck crew went off to scour the Union Hall, the Inuit Center, and The Whale's Belly for Asian fishermen. Rosey and I went down to the end of the pier and waited for the paracops.

They arrived with the daylight. Their VTOL landing craft broke through the low-hanging cloud deck over the mouth of the harbor and hovered over the water, its turbines screaming relentlessly. The pilot eased the craft towards the shore, crossing a broad stone ramp that dipped into the water beyond the pier and coming to ground about fifty meters away from us.

We shielded our eyes against the dust and snow that the engines threw up, then waited for the doors to open. The VTOL carrier was slung low between its engines with a ground-hugging cockpit that resembled the skull of a reptile.

A handful of men in armor and helmets toting assault rifles spilled out of the craft and took up positions around it. A pair of officers strode down the landing ramp and looked about.

"Which one's the *Polar Star*?" the junior man asked.

We pointed him in the right direction and the two marched down the pier. When they were completely out of sight, I gave the word to Rosey and we put the plan into action.

Rosey gave a signal to the girls she had rounded up and stationed up the street from the waterfront. They strolled on down towards the landing craft, laughing and joking and tossing a lot of hair. When they "discovered" the cops, the group fawned over the guards and sighed at the sight of their craft.

Then Rosey and I made our move. We walked past the guards and up the cockpit. "Coast guard," I said with a

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wave. "I just want to talk to your pilot."

The guards hesitated, then Rosey went over to one of them and started to explain.

The pilot slid open a window in his door and slid a dark visor back over the top of his helmet. He was a young warrant officer with a crew cut and a mouthful of chewing gum. "It's about time you guys showed up," I said. "We thought you'd be here last night."

"Bad weather," the pilot said.

"Where are you from?" I asked. I couldn't think of anything better at the moment. I was trying to stall for time until Charlie finished his job.

The pilot's name was Jimmy, he was from Seattle and he'd been a cop for eleven months. He was about to tell me about his mother back in Washington when Charlie showed up, leading a line of about thirty stumbling, bleary-eyed fishermen. The rear of the line was brought up by a pair of sailors pushing a wheelbarrow carrying the motionless body of Captain Herkalian.

The guards watched the procession go by, but did nothing to stop it.

When the last of them was gone, Charlie came back up the pier, waved to me, and headed back to the icebreaker. I looked at my ship and wondered if Sweeny was going to fail me or not. As Charlie passed the bow of the ship, the 130-millimeter gun mount rotated towards the paracop landing craft, its warning bell echoing across the chill waters of the harbor.

"Look, Jimmy," I said, "you see that ship behind me?"

He squinted and craned his neck—as though that would improve his view of the pier a hundred meters away. "I sure do," he said.

"Do you see the 130-millimeter gun at its bow?"

He did.

"Notice how the barrel of the gun moves up and down when I wave my hand," I said. I demonstrated and made one more silent plea for Sweeny to get it right. The ten-meter-long gun barrel rose and fell in a brief salute, then it tracked back and forth slightly, lining up on me, the pilot, and the landing craft.

"That gun is loaded," I told the young warrant officer from Seattle.

He nodded solemnly.

"In a few minutes, the big ship on the other side of the pier is going to get underway and all the little boats and that trawler over there are going to follow it," I said. "When that happens, I want you to remain perfectly still. I don't want you to say anything or do anything. Because if you do anything to sound an alarm or if you try to stop those boats from sailing, my friend in that gun over there is going to fire it. Now that gun fires a fifty-kilogram shell at a muzzle velocity of a thousand meters per second. You wouldn't like what that could do to this landing craft."

The pilot's eyes widened in surprise as my meaning sank in. Then he tried to stand up, only to be caught on his flight harness. He began tearing at that when I tried to calm him down.

"Hey, Jimmy, take it easy. As long as I'm standing right here, you've got nothing to worry about. My friend won't shoot until I'm out of the way."

"I don't believe you," he said.

"That's your choice," I said. "But

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if you're wrong, it's going to make an awfully big noise when that gun goes off." And if you're right, I thought, you can always claim I had a gun pointed at you.

"What are you trying to do?" he asked.

"I told you. I just want you to let these fishermen leave in peace."

He looked at the ships and he looked at the guards. He looked at the bow of the *Polar Star* and he looked at me. "You're crazy," he said, then he folded his arms across his chest and turned his head away.

The trawler headed out first, white steam leaking out her stacks from overpressure valves. Then the factory ship slipped out into the harbor behind her. A flag went up on the main mast to signal that the ship was broadcasting power and the slave boats began pulling away from the docks. In a few minutes, they were through the harbor mouth and battling the open sea.

I was nearly up the pier when I saw Captain Haywood and Maggie come running down the main deck of the *Star* and out to the gangway. The two paracop officers were right behind them. Haywood looked out at the departing fleet and turned red. Maggie just looked puzzled, then smiled.

Then they saw me.

I didn't care. I just wanted to tell Maggie Thorsenn that she could stop nagging me. I'd finally taken responsibility for something.

The fishing fleet made its way quickly to the southwest after leaving New Egg Harbor. On orders from Alaskan Coast Guard Headquarters, the *Star* remained in port and did not try to pursue them—headquarters had always considered the mission complete once the fleet was escorted out of the Bering Sea.

The paracops were confused, but outmaneuvered. Without the fishermen, there could be no more threat to public order. And no more excuse for them to land in force. They couldn't tell if Haywood was a monumental fool or master conspirator. All they could do was file charges against me—something vague and indefensible like "breach of discipline" or "conduct prejudicial to good order."

Captain Haywood didn't say a thing to me after that. That meant it was no longer a personal matter and had become official. I knew my days in the coast guard were numbered.

On the way back to Kodiak, Maggie met me after dinner one day. It was a moment of calm weather when you could stand on the fantail and admire the view. That afternoon, the view included a sky full of puffy, grey clouds and brisk winds, and a bright blue sea full of low, sharply breaking waves.

"They'll have to put you up on sanctions," she said.

"I know," I replied. "Do you suppose I'll lose any seniority?"

"I'll see what I can do to help you there. It's the least I can do," she said.

"Thanks."

"I should be thanking you," she said. "You know, Magistrate Donaldson told me to give you a message. He said to tell you that history is the process by which people become aware of themselves as the authors of their own destiny."

"That sounds like him."

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"He also said to thank you for the dinner," she said. "Look, Brume, I'm sorry I made you do it. I wish it didn't have to turn out this way."

I laughed. "Maggie, you didn't make me responsible. I already was—already am responsible. And I'm not sure you even know what the word means."

She snorted in disbelief.

"No, really. Listen to me for a minute. You think responsibility is something you're obligated to do. But that's not responsibility, that's duty. And duty is something that people with power want the rest of us to do for them."

"I'm not sure I agree with you there," she said.

"Of course not. That's because it isn't in your interest to agree with me there. Real responsibility means the ability to respond. To respond to necessity—not duty. One comes from inside, the other is forced on you from the outside. Me, I saw something that needed doing and that was my response. Freely made, so the choice was mine."

"What are you talking about?" Maggie asked, narrowing those bright eyes of hers.

"Your problem is that you have a lot of power, but no responsibility," I said. "You wanted me to take responsibility for you. But when people aren't obligated by fear or poverty or starvation, it's hard to get them to do what you want, isn't it? So you tried to shame me into it. But I did it for my own reasons, not because I felt obligated to you. Most of all, I did it because it was the most fun I've had in years."

"Brume, you're impossible," she said. "What am I going to do with you?"

"Nothing, Maggie. In a few days, I won't be your responsibility anymore."

She laughed, shook her head, then walked away.

I watched the Sun setting behind us and the ship's wake as it widened into the distance. I felt good. I didn't know where I was going, but I knew it was somewhere new and different. And I knew that sometime in the past few days, I had stepped across a line and forever put myself beyond the Big Circus. ■

A life consisting exclusively of things that are Good For You is bad for you.

Kelvin Throop

Rules are solutions to yesterday's problems.

Kelvin Throop

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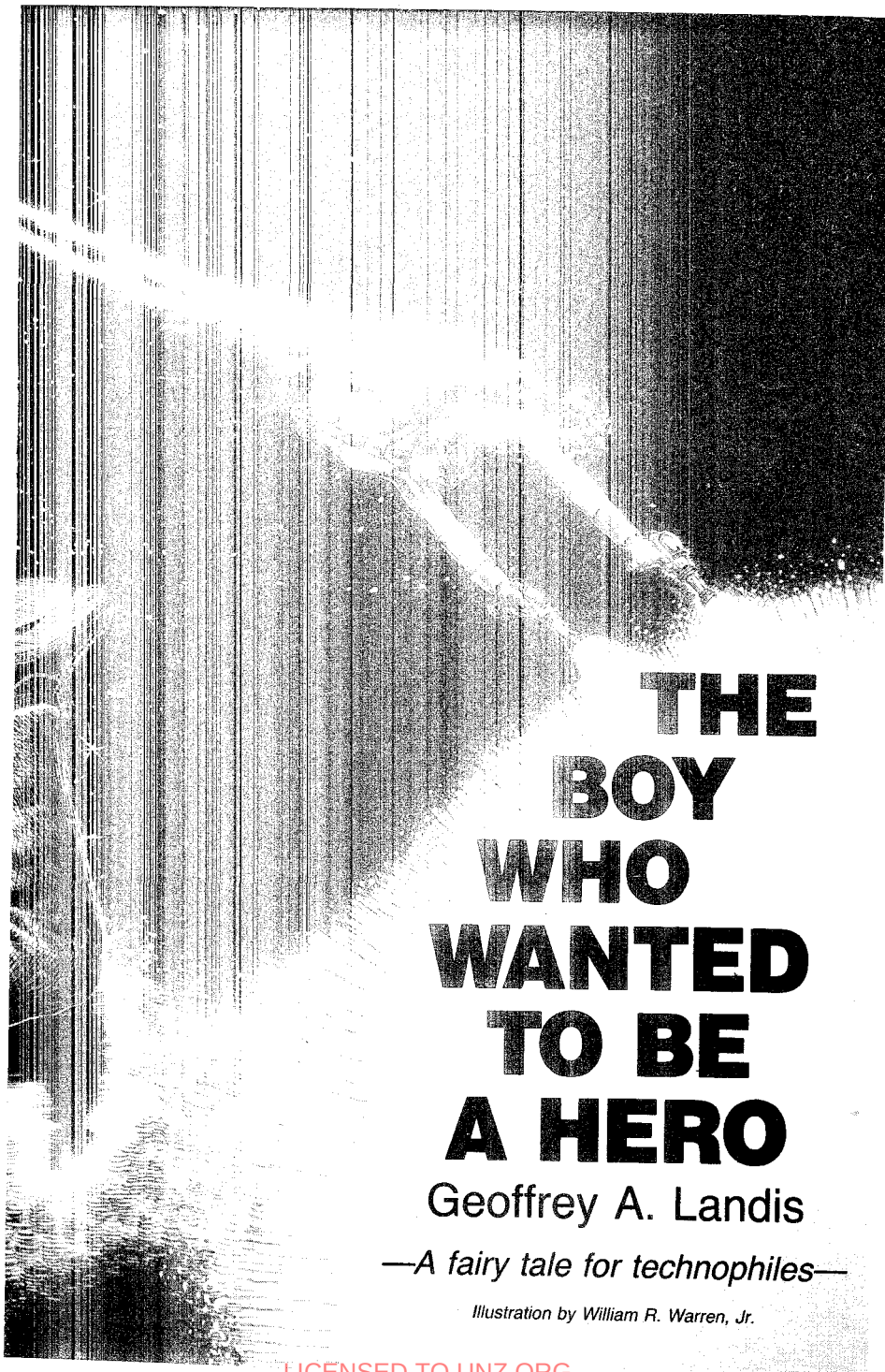

THE BOY WHO WANTED TO BE A HERO

Geoffrey A. Landis

—A fairy tale for technophiles—

Illustration by William R. Warren, Jr.

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Once upon a time there was a boy who read fairy tales. The fairy tales he read had names like "Flash Gordon's Trip to Mars," and "Buck Rogers in the 25th Century," and "Handbook of Amateur Telescope Making." He decided that when he grew up, he would be a hero and travel to far distant planets. Even when he found out that distant planets didn't have princesses or even evil emperors named Ming, he still remembered his dreams and wanted—

—Yes, of course girls can be heroes too. This is a story about a boy who wanted to be a hero. It could be a story about a girl who wanted to be a hero, but that would be a *different* story—

And so he studied space, and astronomy—and baseball, too, since he was just a boy. One day he was reading a book and he found a prophecy of terrible doom, far worse even than any evil that Ming the Merciless could devise. In time, he read, in a billion years or so, the Sun was going to swell up like a balloon into something called a red giant, and then the very flames of the Sun would reach out and lick the Earth and burn everything on it to a cinder. Gee, he thought, when that happens we're all going to die, even the puppies and the cockroaches, even the weird things that live at the bottom of the ocean where the Sun doesn't even shine. And so he made his resolution. The world desperately needs a hero, he decided, to make spaceships to fly away from the Earth and let us all escape the doom. And why shouldn't this hero be him?

His parents and his friends and even his teachers (who should have known better) told him that he was childish and foolish, and anyway the Sun wasn't going to swell up for a long long time, and who cares about that when we have problems of our own right now? But he had the dream, and their words were less than spiderwebs to him, for he knew that if he only were persistent enough and studied hard enough, he could become a hero and save the world.

And as he grew up he watched in wonder as astronauts flew to the Moon. He cheered and waved and watched them on television for days on end, knowing that they were heroes, and that one day he would be one too.

But people forgot. People said, if we can go to the Moon, why can't we do this? Or that? Or something else that really had nothing at all to do with the Moon? So the space program died, and nobody ever went back to the Moon. And there was a space station, but nobody wanted to pay for it, so it died, too. And though he studied and studied to become an astronaut, nobody wanted astronauts any more.

So he said, well, then, I'll make my own rockets. I'll make a company that makes rockets, and though I'll pretend to be interested in making money, I'll really be getting rockets ready to go to Mars. Even if I can't go myself, I'll make it possible for someone someday to

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go, and at least I'll know that I was part of it.

He found many monsters for a hero to slay. He encountered apathy and indifference, at best; and derision and even outright hostility at worst. He learned to hide his dreams, because only then would people take him seriously. He learned to tell people that he wanted to build rockets to launch communications satellites, so people could watch television from around the world; that he wanted to make weather satellites, so that all the televisions could have weathermen with colorful pictures of clouds. And he was very persuasive, and became quite successful, but he found that the more successful he became, the harder it became to devote time to his dream.

And there were other heroes opposing him with different quests, like saving whales or saying no to drugs. At first he came back from these fights all bloody and bruised, but he learned from each defeat, and at last learned to fight like they did. He became very good at making alliances when it suited his purposes, and then stabbing his allies in the back when it didn't.

The biggest of the monsters was a huge giant named Congress. This giant had a thousand tentacles that liked to tie people up in knots so they couldn't move, and for each knot you got untied, ten more tied you from the other direction. The boy discovered that there was no way to defeat this monster, really, but it only had a very tiny brain, and not much attention span. He discovered that if you were very patient and didn't make much noise when its attention was on you, it would get bored and go look for more exciting prey somewhere else, and then you could sneak through a loophole and do whatever you needed to.

And so, the boy grew up. He didn't make rockets, but he helped develop new electronics to make satellites smaller, so that they could be launched on smaller rockets, and more reliable, so that they would not need to be replaced as often. In this way he saved his company a lot of money that would have otherwise been spent on rocket launches. He made lots of money, too. In fact, he eventually got to own the company, which was a very large one, and became very very rich. And he got old.

One day a little girl came to him.

And the little girl (who wasn't so little, really) told him how his company could make lots and lots of money by taking platinum and precious metals out of the asteroids. And he laughed, and said, but that isn't really why you want to do this, is it? And she told him how they could make money building hotels in space, and how they could make his country technologically advanced and respected by all the rest of the world (which it had been, once, but that was back in the days when they went to the Moon, too). And he laughed, and said, but that isn't really why you want to do this,

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is it?

And the little girl told him her secret dreams, which were that she believed in fairy tales, ones with names like "Star Trek," and "2001: A Space Odyssey," and "One Small Step for Man."

And he smiled at her, and told her that her dreams were just fairy tales, and that she should forget them and do something practical; for you cannot ignore your dreams without them fading and being forgotten.

And they lived, not necessarily happily ever after, since that happens only in fairly tales, but they lived.

—No, that's not the end of the story—

And a few thousand years went by, and nothing much changed. Every now and then somebody would read the old, old fairy tales and think, gee, I wish we could go into space, but all the coal and oil and iron and chromium on the planet got used up long ago, so they couldn't do much other than wish. And a billion years or so went by, and the Sun expanded into a red giant like everybody knew all along was going to happen some day, and so everything on the Earth got burned into a crispy cinder.

—No, of course the story has a happy ending. Don't fairy tales always have happy endings?—

Far, far away there was a planet called "Pluto" that used to be way too cold for anybody to live there, but when the Sun swelled up it got nice and warm and just the right temperature for life, and eventually creatures crawled out of the ocean and looked at the stars and thought, gee, why can't we go out there? And they had ten legs and eyes on the ends of stalks, and didn't look at all like people, and never even knew that people had ever existed.

What? You don't think that's a happy ending? Well, then, you can go ahead and make your own ending, if you want to. Anybody can. ■

If carried too far, virtues can evolve into various faults.

Eugene T. Maleska

Think like a man of action, and act like a man of thought.

Henri Bergson

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NEUTRINOS, RIPPLES, AND TIME LOOPS

Once in a while I do a "clean up" Alternate View column that contains follow-ups on previous columns and provides short discussions of ideas and developments that are not appropriate for a full-length column. This is such a column.

•**Solar Neutrinos are Up**—My September 1992 column on recent results in neutrino physics (no neutrino counts at SAGE and negative mass-squared data suggesting that the e-neutrino may be a tachyon) prompted more reader response than any other column in recent memory. Two months after I wrote it, a new result from GALLEX, the European gallium neutrino-detection experiment housed in the Grand Sasso underground laboratory in Italy, was announced. GALLEX uses the same technique as the SAGE neutrino experiment described in my September column: many million dollars worth of elemental gallium (element 31) is purified and placed in underground tanks where solar neutrinos transmute stable gallium 71 to radioactive germanium 71 (half-life 11.4 days). A chemical process separates the new radioactive germanium atoms from the bulk gallium and transports them to a sensitive detector where their decays are counted.

Because the elements of the experiment are the same for SAGE and GALLEX and they are measuring the same flux of solar neutrinos, one would expect them to give consistent results. That is not exactly obvious from the numbers. The GALLEX experimenters report observation of 83 $\pm$19(statistical) $\pm$8(systematic) SNU (solar neutrino units, the standard measure of solar neutrino flux) while standard astrophysical models of the fusion processes in the Sun would predict about 128 SNU. The SAGE experiment, on the other hand, produced a result that was essentially zero: 20$\pm$20(statistical) $\pm$32(systematic) SNU. Both experimental groups placed sizable statistical and systematic error estimates on their measurements, and these error-bars are sufficiently generous that the two results actually overlap, although just barely. Nevertheless, the physics

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community is concerned that there may be some fundamental problem with design or execution of the SAGE experiment. Soon both SAGE and GALLEX will be checked by placing very intense radioactive neutrino-emitting sources within the experiments, so that their efficiencies for detecting neutrinos of known energy and intensity can be directly measured.

If the GALLEX results are taken at face value the solar neutrino problem is less severe than had been assumed when only SAGE had reported in. And some of the theoretical suggested mechanisms for "explaining" the SAGE results will pass into that section of limbo reserved for theories that do not agree with experiment.

The other recent result mentioned in my column, the consistently negative measured value of the mass-squared of the electron neutrino, is still with us. I have not yet seen any papers in the physics literature, however, which take seriously the possibility that the electron neutrino may be a tachyon. Paradigm shifts take time.

•Ripples in the Big Bang—The big science news of May 1992 was the demonstration of non-uniformity in the cosmic background microwave radiation provided by careful analysis of NASA's Cosmic Background Explorer (COBE) satellite. Considering their importance, I should have done an AV column about these results at the time they were announced. However, I was in Geneva at the CERN laboratory doing an experiment at

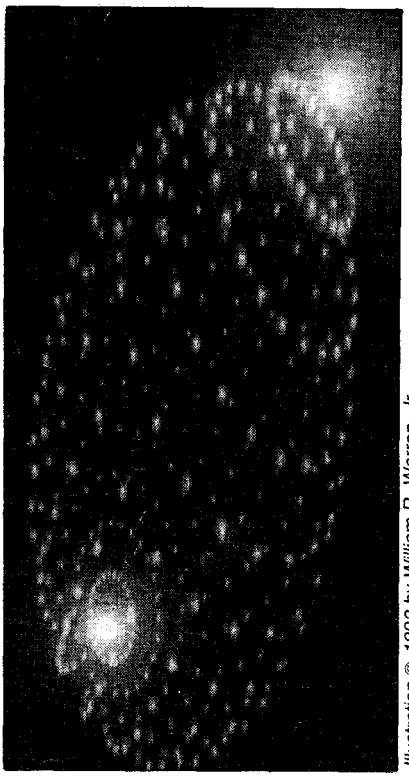

Illustration © 1993 by William R. Warren, Jr.

that time, and the facts on the COBE results provided by the BBC and the *Herald Tribune*, my principle sources of news at CERN, were sketchy and rather garbled.

The discovery of the variations in the 2.73° microwave background is very important. We know that while the Big Bang was very smooth, our present Universe is very lumpy and full of irregular chunks of matter such as galactic clusters, galaxies, and stars. Cosmologists have been fretting for decades over the question: "When did the lumpiness occur?" The destabilizing action of gravity must have

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caused the early Universe to "curdle" into clumps of matter at some point, but up to the COBE announcement, there was no trace of the onset of this process.

The irregularities in the microwave background provide this missing information. We now have a measure of the scale of the variations, a scale frozen into the microwave radiation when it decoupled from the matter in the Universe not long after the Big Bang itself. The variation in the microwave background can be considered as a progress report on the formation of the Universe that has been beamed to us on a microwave channel by the Universe itself from 100,000 years after the starting gun of the Big Bang.

The COBE results represent hard data that, from this point forward, will provide a stringent set of tests for any theory of cosmology that attempts to describe the early Universe. The questions surrounding the presence and role of dark matter in the formation of stars and galaxies now have a new observational constraint. It's going to be interesting to watch the interaction of the COBE results with cosmological theories in the next few years. Watch this space for further developments.

•**Causality Loopholes in General Relativity**—The law of causality, the principle that a cause must always precede its effects in every reference frame, is one of the most fundamental laws of physics. It is also one of the most mysterious, because its origins and mechanisms are not well understood. Until a few years ago general relativity, our standard theory of gravitation, was a good example of a theory that preserves causality by preventing "causal loops," better known in SF as time travel paradoxes.

Of course, lurking in general relativity are wormholes (see my AV columns in the 6/89, 5/90, and 7/92 issues of *Analog*) which can provide spatial and temporal shortcuts, and "singularities," points at which forces become infinite and the laws of physics including causality must break down. However, whenever a peculiarity like a wormhole or a singularity threatened a causality violation, a mechanism was always found within general relativity to preserve causality. Wormholes were shown to be dynamically unstable, so that not even a photon could pass through to make a causal loop. The bizarre physics of the singularity was believed to be walled off from the real world by what Roger Penrose called "cosmic censorship." Penrose suggested that the event horizon of a black hole would always screen the singularity from access, eliminating the possibility that a "naked" singularity could have bizarre interactions with our Universe.

So the peculiarities were present in the theory, but for each peculiarity there was a mechanism that preserved causality and blocked the possibility of closed-loop paths through time. This secure position of causality within general relativity is now being progressively eroded. The first breech was provided by Kip Thorne's work on wormholes, which has been

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extensively discussed in this column. In brief, Thorne's group discovered a mechanism at the boundary between general relativity and quantum mechanics (using the Casimir effect) for stabilizing wormholes so that they could, in principle, be used for faster-than-light travel and time travel. The work of Thorne's group is taken quite seriously within the physics community and papers are regularly appearing in refereed physics journals that explore various aspects of wormhole-based time travel. Causality is dead if wormholes can be stabilized.

Another assault on causality came from the unlikely direction of "numerical" general relativity. When a star uses up its nuclear fuel it becomes dynamically unstable and goes into gravitational collapse, producing a supernova explosion and, if the star is massive enough, forming a black hole. Exact mathematical solutions of Einstein's general field equations, as they apply to gravitational collapse and black hole formation, are known for only a few highly symmetric situations because of the great mathematical difficulty of solving the equations. With the availability of supercomputers, however, it is now possible to obtain reliable *numerical* solutions to Einstein's equations for situations where the system is *not* symmetric in space, where the in-falling matter is clumped in arbitrary ways rather than arranged in a perfect sphere.

Last year Stuart L. Shapiro and Saul A. Teukolsky of Cornell University, reported work in which they had used a supercomputer to examine the gravitational collapse of a football-shaped swarm of particles with an eccentricity (axis ratio) of about 2.3. This work produced a big surprise. As the collapse progressed the mass distribution assumed a spindle shape with a point at each end. Soon at each of the two points a *naked singularity* formed. The computer halted at this point, unable to proceed with the calculation after the singularities appeared because of numerical overflows resulting from the infinite forces at the singularities.

The implication of the Shapiro-Teukolsky work is that Penrose's cosmic censorship is not a universal consequence of general relativity but rather a special condition which only occurs in fairly spherical and symmetrical collapse processes. Since real stars are not likely to be spherical, particularly when they are members of a binary system, there seems to be a real possibility that naked singularities occur from time to time in our galaxy. The implications of this conclusion are now being intensively studied.

In the wake of the Thorne and Shapiro-Teukolsky work there remained some hope of restoring general relativity to its former state of causal purity. Perhaps unknown quantum-gravity effects would de-stabilize Thorne's wormholes. Perhaps in the Shapiro-Teukolsky calculations the seemingly naked singularity was the consequence of numerical inaccuracies in the calculations when the density became too large. Perhaps when we learn more, we will see that causality is still OK.

Such hopes have been largely

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dashed by the recent work of James Gunn of Harvard. Gunn has been doing exact analytical calculations of general relativity applied to the physics of cosmic strings (for which, see my 4/87 column in *Analog*). Cosmic strings are very massive "fault lines" in space itself that may have been produced in the early Big Bang, that may be responsible for the formation and shape of galaxies, and that may still be around or may have long since destroyed themselves by dissipating into gravitational radiation. The peculiar characteristic of the gravitational field around a cosmic string is that it is represented by a *conical* distortion of space. Because the distortion is conical, there is no observable attractive force in the vicinity of a cosmic string, despite its enormous mass (perhaps 1.5 Earth-masses per meter of length).

A flat sheet of paper can be made into a cone by removing a wedge-shaped slice from the sheet and joining the cut ends. The conical distortion of space around a cosmic string has such a missing wedge of space, a "spatial deficit." Because of this spatial deficit, a circle enclosing a cosmic string contains less than 360° of angle.

Gunn discovered that the peculiar conical gravitational field around a cosmic string produces an even more peculiar "gravito-magnetic" effect when the cosmic string is set in motion. The spatial deficit becomes a timelike deficit. Gunn considered this effect in the region between two parallel cosmic strings that are separated by a small distance and are moving in opposite directions at very nearly the velocity of light. In this circumstance a circular path enclosing one of the strings and passing between them has the remarkable property that it can form a causal loop. In one direction around the circle the trip time is increased, while in the other direction it is reduced *or even made negative.*

Thus, a violation of the law of causality can be produced within the framework of general relativity. The remarkable thing about Gunn's calculation is its simplicity. Once set up, the extraction of the bizarre solution with its closed time-like loops is very straightforward with standard mathematical procedures. There seems no remaining escape from the conclusion that time travel is implicit in general relativity. From the viewpoint of physics, that is a disaster and perhaps an indication that general relativity is in need of revision. From the viewpoint of science fiction, however, the possibility of time travel is a very pleasing development.

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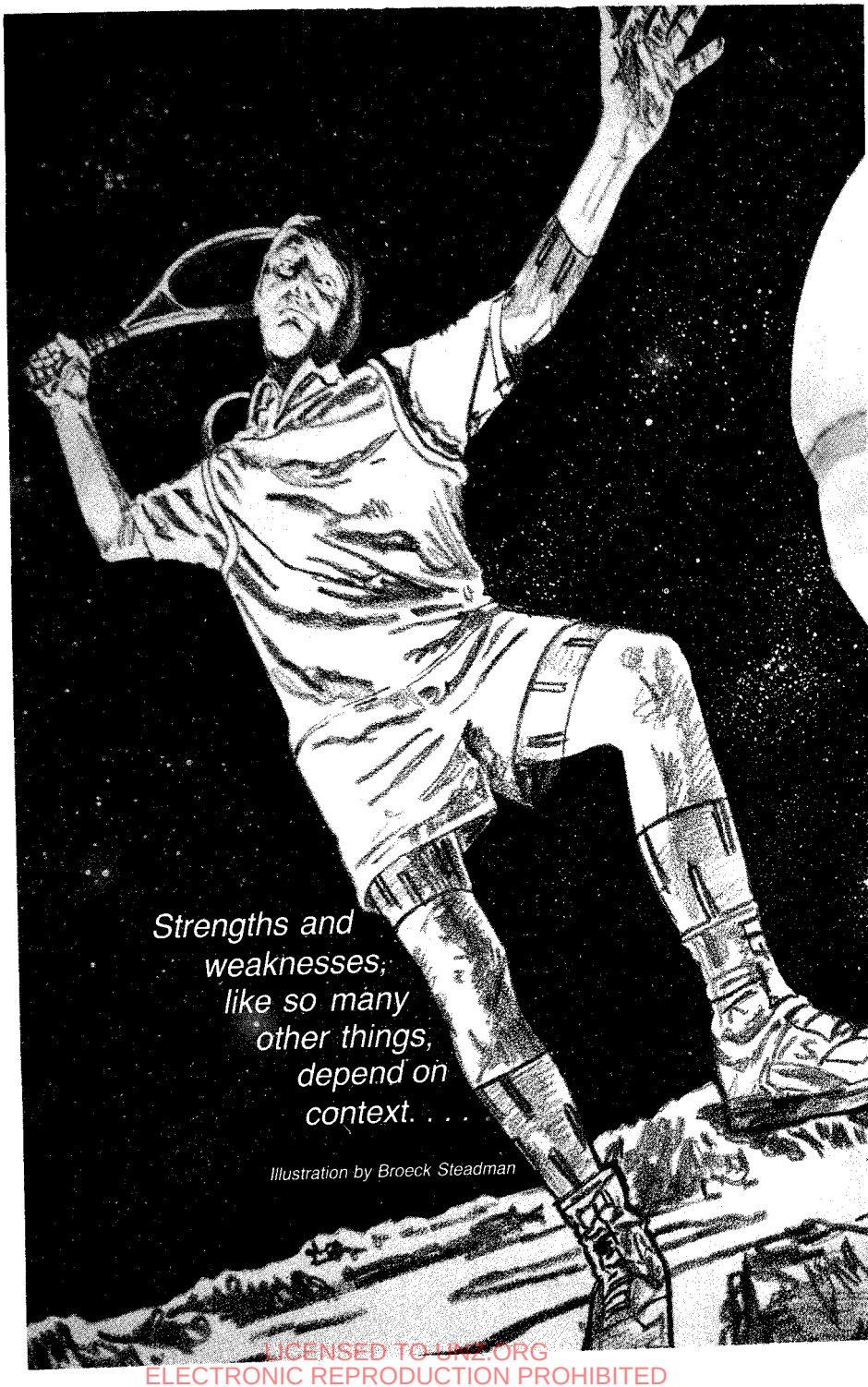

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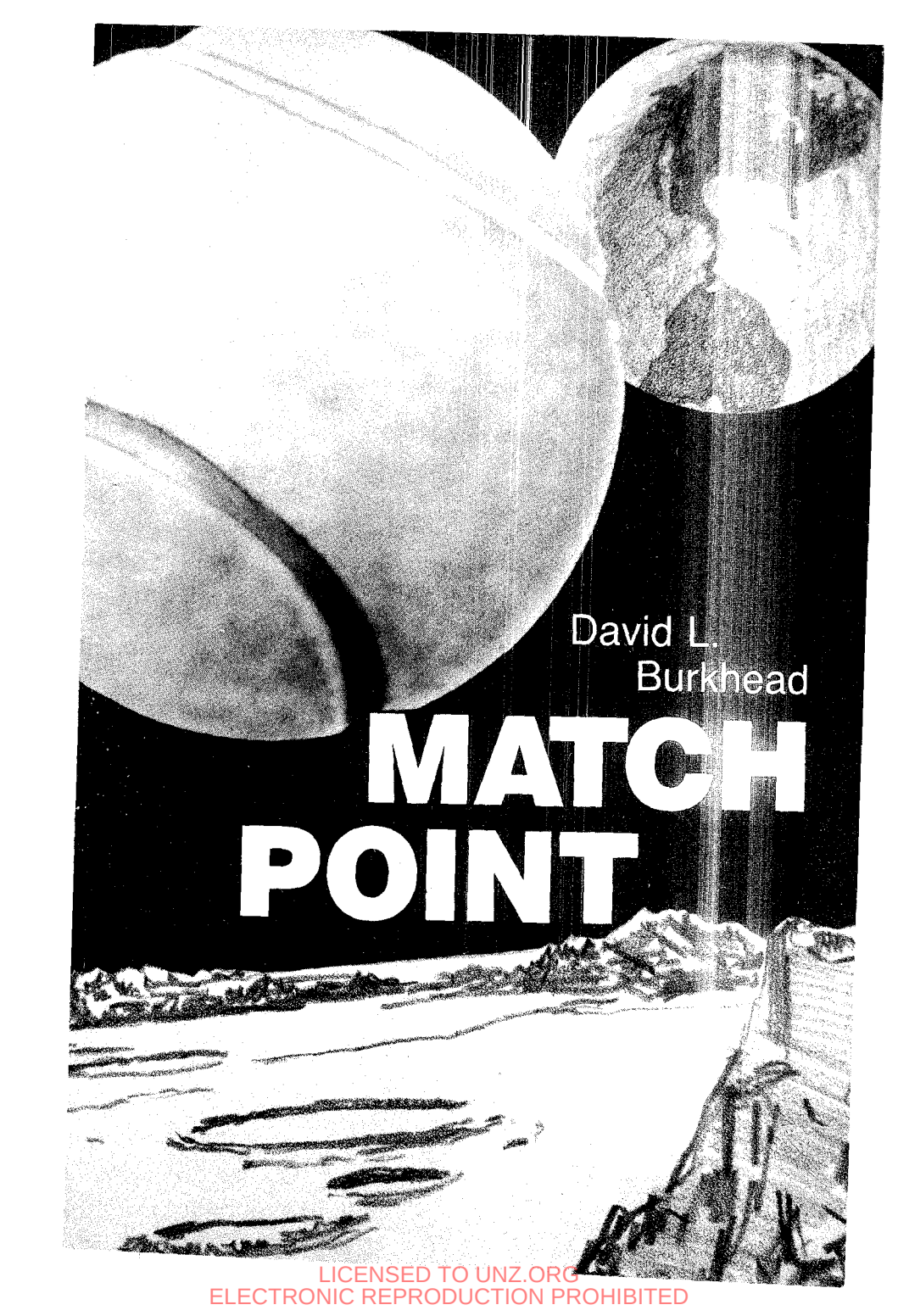

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What is it about hospital food? We've got colonies in space and on the Moon, outposts on and around most of the planets, and still hospital food tastes like reprocessed waste paper.

The news jerked my attention from the food in front of me to the TriVid. It was about me.

"Mr. Bradshaw," the reporter said, "What are your thoughts on tennis player Tom Stryker's illness?"

Tom Stryker. That's me.

"Well, Aaron," Steve Bradshaw said, "I was terribly sorry to hear about it, of course. For most people, Brenberg's disease would be no more than a nuisance. For a top athlete, such as Mr. Stryker, it's crippling."

I frowned. I had had the explanation from the doctor. Brenberg's disease attacks the nervous system. The first stage of the disease requires hospitalization, mostly to keep the patient from injuring himself as a result of random nerve firings. Later the firings stop and the disease recedes to a mild, almost unnoticable, level. It's not even contagious. All it does is slow reflexes. That's all. It just ruins my life. Two months before, I had been the number four rated tennis player on Earth. Now, I doubt I could beat a good club player.

Bradshaw was continuing. "Of course, he was already on the downside of his career."

I convulsed, nearly coming out of the bed. "Downside of my career? Who does he think he is?"

The special report ended and they went on with the usual talk about crime, disasters, and other assorted bloodshed. I shut off the TriVid.

The food on my tray remained half uneaten. I had no real interest in finishing it and shoved the tray aside. I thought about what I had heard Bradshaw say. He really had no business commenting on my career. On Earth, Bradshaw was never more than a hacker. It was only when he moved off planet and began playing the low-*g* variant of tennis that he'd come into prominence. Among other things, low-*g* tennis was a much slower game.

I froze, the thought half formed. Low-*g* tennis *was* a much slower game. My ruined reflexes would be less of a handicap.

I picked up the phone and dialed my manager's home number.

"Collins," his voice sounded in my ear.

"Hi, Bill," I said. "This is Tom. Did you hear Bradshaw's cracks on the news?"

"Yeah," Bill said. "He was a little tactless, but essentially correct."

"My career was *not* on the downside!"

"Of course not," Bill said, "but it's over now."

"I'm not so certain," I said. I outlined my thoughts about low-*g* tennis. "I'd like you to arrange a match for me, with Bradshaw."

"You're kidding."

"Not at all," I said. "I'm going to shove Bradshaw's words down his throat."

"I really don't think this is a good idea," Bill said. "I'm not going to let you do this."

"You're not going to let . . . ?" I felt my eyebrows climb up to my hairline. "Bill, you work for me. Remember?"

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"Yes," Bill said. "I do remember. I also remember that I'm supposed to look after your interests."

"Are you going to arrange this match or not?"

"No. I'm not."

"All right," I said. "You're fired." I hung up.

Two days later, the doctors released me from the hospital. I spent another day at home, just resting, before calling Bradshaw's manager. Since I'd fired Bill I'd have to arrange the match myself.

I had to wait for an open circuit off-planet. Bradshaw was based out of O'Neill, the L5 colony, and a lot of message traffic went that way.

A few minutes later the phone rang. I picked it up. "Hello?"

"Mr. Stryker, your call is ready," the operator said.

"Thank you."

A moment later I heard the ringing at the other end of the line.

"Farris and Associates," I heard. "Julie Farris speaking."

"Yes, Ms. Farris, this is Tom Stryker. I wanted to arrange an exhibition match with Mr. Bradshaw if I might."

I tried to put everything into as few words as possible. Off Earth, real-time calls were expensive.

"A match?" Julia said after the three second speed-of-light transmission delay. "You know that Steve doesn't play on Earth. He doesn't want to hurt his instincts for low-*g*. I'm sure you understand."

"Oh, quite," I said. That covered him. After all, he wasn't even rated on Earth. In space, on the other hand, he was number one. "I was thinking of an off Earth match anyway. Say, Lunaville?"

Her response was delayed by more than the three seconds it took for the message's round-trip. "Steve has a pretty full calendar. Why don't I let you talk to him? He may be willing to bump something."

"Thank you," I said.

A moment later a new voice came on the line. "This is Steve Bradshaw. Is this Tom Stryker?"

"It is," I said. "I'd like to arrange a match. You and me."

"Are you sure that's a good idea?" Bradshaw asked. "After all, your health . . ."

As his voice trailed off, I said, "My health is just fine, thank you."

"Of course," Bradshaw said. "I'm willing, but are you sure you want to do this? With your reflexes shot—not your fault, I admit, but true nonetheless—you can't possibly win against top competition. I'd hate to see you publicly humiliated."

That angered me. "You worry about your game, I'll worry about mine. Are you willing to meet me or not?"

"Oh, I'll meet you all right, but I'll have to bump another game from my calendar so you'll have to make it worth my while. Tell you what. You get sponsors to put up a purse of, say, three million. Two to the winner, one to the loser. Do that and give me two months notice and I'll meet you at a time and place of your choosing as long as it's low-*g*."

I considered for a moment. It was a pretty good deal, certainly the best I'd

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get out of him. I'd still have to find the money from somewhere. "All right," I said. "It's a deal."

"It's a pleasure doing business with you," he said. "I look forward to hearing from you."

I said good-bye and hung up. Three million was an awfully big purse for a single match. I had no idea where I would get it. Four years earlier and I would have been able to put it up myself. While I was still comfortable, I could not lay my hands on that kind of ready cash. Besides, that would have defeated the point. The idea was to make money by playing tennis, not lose it.

I thought it would be easy to get the sponsors to put up the purse for the match. I was wrong.

"I'm sorry, Mr. Stryker," Ilya Botvinnik, publicity director for Emperor Sports Supplies, said. "With your illness we just can't see putting our name on this match. It just wouldn't be good business."

"I see," I said. I had gotten the same response, or a similar one, from everyone I had called. I began to wonder how Bill had managed all those years.

"I really am sorry," Botvinnik said. "I hope you realize that we wish you the best of luck here at Emperor."

"I'm sure," I said, and hung up.

The news was running again. And again Bradshaw had shoehorned himself into an appearance.

"It's tragic really," Bradshaw said. "Stryker just won't let go. This match he's trying to arrange is just his effort at holding on to his former glory. I've seen it in older athletes, making comeback after comeback only to embarrass themselves. In Stryker's case it's more intense because of the suddenness of his fall."

"But do you accept his challenge?"

Bradshaw laughed. "There's no challenge to accept. Not only are his reflexes shot, but he's never played in low-*g* before. It's an entirely different game up here. If he insists, I'll play him, but it won't be much of a match."

I snapped off the TriVid. "Just keep talking, Bradshaw," I said. "Just keep talking."

The phone rang before I could get really wound up.

"Stryker," I said into the mouthpiece.

"We have a call from O'Neill for one Tom Stryker," a pleasant voice said. "Is this he?"

"Yes," I said. If Bradshaw was calling I had some words for him.

"One moment, sir."

A couple of seconds later a different voice came on the line—male, rather deeply pitched. "Mr. Stryker?"

"Yes?" I said.

"This is William Schneider," the voice said. "I head FTI. Perhaps you've heard of me?"

"I have," I said. How could I not? FTI was the largest corporation in the system. "What can I do for you?"

"Well," Schneider said, "We've got a tennis player up here who's been making rather an ass of himself with the news services. How would you like a chance to put him in his place?"

I liked Schneider already. "What do you mean exactly?"

"It's pretty simple, really," he said. "I'll put up the purse for your

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match—FTI can certainly afford it—and have you brought up to Lunaville to train. What do you say? Are you interested?''

Was I interested? Did he want my soul in exchange? ''I'll need a coach,'' I said. ''One who knows the low-*g* game.''

''You'll have one,'' Schnieder said. ''Also unlimited court time.''

''OK, I'm in,'' I said. How could I refuse? He was giving me everything I wanted.

''Great! I'll have your travel arrangements made and wired to you.''

''Sounds good,'' I said.

''Then I'll meet you at Lunaville. 'Bye.''

'' 'Bye,'' I said and hung up.

I slept better that night than any since I left the hospital.

A week later I arrived at Lunaville. As I stepped off the ship I bobbed nearly two feet in the air. With my next step I bobbed again. I tried to compensate, to walk more gently, but still I bobbed more than a foot with every step, taking more than a second to drift back to the floor.

I stopped for a moment, one hand grasping the boarding tube's handrail. This wasn't going to work. I couldn't even walk right; how could I play tennis? Bradshaw could return my shots while I drifted lazily through the air, unable to do anything about it.

''Is there a problem, sir?'' A flight attendant had come up behind me.

I grinned. ''I seem to be having a little trouble walking.''

She smiled back. ''That's OK, sir. It happens a lot. First time here?''

''First time,'' I agreed.

She nodded. ''Perhaps you will allow me to assist?''

With a sigh, I consented. She took my arm. ''You need to lean a little more when you start, and again when you stop.'' She made a shuffling step, dragging me along, as she demonstrated. ''See?'' she said.

I said I did and tried to imitate her. Despite my effort and her hand on my arm I still bobbed into the air, but not as badly as before.

''That's it,'' she said. ''It just takes practice.''

''I see. Thank you very much.''

''Not at all, sir,'' she said. ''Allow me to escort you to the gate.''

I didn't want to; it was too embarrassing, but I began to see that I would need help, at least a little farther. ''All right,'' I said.

I had mostly gotten the hang of walking by the time we reached the gate. It was just a matter of developing a new set of instincts.

''Here you are, sir,'' the flight attendant said as we neared the gate. ''I think you can manage now.''

''Yes, thank you.''

''Then I'll be running along. Take care, Mr. Stryker.''

So she had known all along who I was. So much for hiding behind anonymity.

''Tom Stryker?'' A woman, mid-thirties, red hair, blue eyes, met me at the gate.

''That's me,'' I said.

She held out a hand. I took it. ''I'm Brenda Channing. Mr. Schneider hired me to be your coach.''

''Delighted,'' I said. I looked

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around. "I have a couple of bags somewhere."

"If you want," she said, "I could have them sent straight to your room."

I laughed. "I want."

"Good," she said. "We have a lot of work ahead of us."

"I know," I said. "I'm having trouble even walking."

She shook her head at my admission. "Most of what we'll be doing is teaching you how to move easily in low gravity. Just be glad you picked the Moon for your match. You don't have to worry about coriolis."

"Coriolis?"

She sighed and explained, as if to a little child, "The colonies generate artificial gravity by spinning. That causes falling bodies, including tennis balls, to do odd things."

"I see." I didn't. "Can we go look at the court?"

She nodded again and turned to lead me down the corridor. Unlike the flight attendant she did not even offer to help. I suppose that was for the best. I had to learn to walk on my own.

The court was more than three times the size of an Earth court, and longer in proportion.

"How in the world am I going to cover that?"

Brenda grinned at me. "It is a large area to cover. Don't worry about it."

"I have to worry about it. I've got to play this match and I'm going to look like a fool."

She sighed. "It's not as bad as it looks. Here." She led me onto the court. "The ball follows a much flatter trajectory in low gravity. We had to enlarge the court to keep the ball from going out on every stroke." Her grin widened. "That would make for a very boring game."

"I see," I said.

Brenda nodded. "Off Earth each court is tailored for the local gravity. Trial and error told us the correct sizes." She pointed out the two baselines. "We made the court longer in proportion to give you the time to cover the extra width." She laid a hand on the net. "The net's higher to compensate for the extra length." She stared into my eyes. "Just about everything you think you know about tennis is different here."

I rubbed at my temples. "I think I may have bitten off more than I realized."

She shrugged, apparently indifferent. "It's still not too late to back out."

I laughed. "Oh yes it is. If Bradshaw runs true to form, he's already held a press conference or two suggesting I do just that. I won't give him the satisfaction."

"All right," she said. While her voice held no emotion, I could see in her eyes that my response had pleased her. "The sooner we get started, the sooner you'll get adjusted. Do you feel up to a slow set or are you tired from the trip?"

I rubbed at the small of my back. Tired? Yes, I was tired but a set of tennis would be perfect for loosening stiff muscles. "My luggage is still in transit."

"I think we can scare up a racket and a set of whites for you to use."

I'd never been so embarrassed in my life. I played better at twelve than I did

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in that set.

The first three games, I bounced so high with each step that I never laid racket to ball, except in game two where I had the serve. Then I never came near Brenda's return.

My reflexes, or rather their lack, did not help. The ball would be halfway back to me before I could even begin to react. This despite the greater distance the ball had to fly, giving me more time.

In the fourth game I managed to stay on the court. The trick was to lean way over when accelerating, lean way back when slowing. The other trick was to go smoothly. By going easily and not pushing I could build up quite a speed—over six or seven steps. I began to return the ball, not often but occasionally.

I was returning the ball, perhaps, but the game still ended with me at love. I kept forgetting what I should be doing and reacting as I had learned on Earth. Each time I did, Brenda won the point.

It didn't help that she kept hollering advice from her side of the net.

"Game five," Brenda called to me. "My serve."

I nodded and took my position behind the service box. This game, I vowed, was mine.

Her serve came to my forehand. I sent the ball back using my best drop shot.

Brenda dashed to the net. Too late.

"Love fifteen," she said. "Nice shot."

"Thanks," I said.

She took her position behind her baseline while I waited by the service box, the other side this time. She bounced the ball a few times before tossing it up.

I think it broke the sound barrier.

"Talk about nice shots," I said.

Brenda half bowed with a lopsided grin. "Fifteen all."

We worked the game to deuce, a tie at forty, then my advantage, then deuce again. Finally my advantage.

I had seen that Brenda did not like my dropshot. The oversized court, especially the length, made it hard for her to get to the net. The instant the ball left her racket on the serve, she charged the net.

I came in under the ball, hitting a high lob—called, appropriately enough, a moonball. The ball sailed over her head as she tried to kill her forward velocity and double back. She ran into the net.

"In or out?" she asked hopefully after untangling herself.

"In," I said. "I believe that's my game."

She nodded. .

She won the next two games, although the second went to deuce five times before she won it.

"That's set," she said.

I nodded, wiping sweat out of my eyes. Low gravity may require less physical energy than high, but the mental energy more than makes up the difference.

I heard clapping coming from behind me.

Brenda looked past me. "Mr. Schneider!"

I turned. William Schneider was walking towards us. I had seen him in advertisements and, occasionally, on the news.

"Well done," he said to me.

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"Thanks," I said, "but I've got a long way to go yet." I took a moment to look him over. He looked to be in his early to mid-thirties although I knew him to be older, forty-three or so. He kept trim but was not fanatical about it. At five nine, I guessed he'd weigh one sixty or so on Earth.

"You listen to Brenda and do what she says," Schneider said. "She'll get you there."

"I get that impression," I said.

Schneider turned to Brenda. "What do you think? How soon can we have him ready?"

"To beat Steve Bradshaw?"

Schneider nodded.

Brenda sucked air over her teeth. "We could spend years and still find improvements to make."

"We don't have years," Schneider said. "In fact, the sooner we can arrange this match, the better."

Brenda looked up at me. "Tom? It's your neck that's going to be hanging out there."

I shook my head. "I don't know enough to have an opinion. I'd rather make the match soon, but I'd also rather win. You're the coach. You tell me."

"Right," she said. "Say a month for the basics, another for fine points. After that we're just fiddling."

"Two months then," Schneider said.

I agreed.

Schneider took me to dinner after I showered and changed out of the whites. He said he wanted to get to know the person he was backing, not just the tennis star.

"I'm curious," I said as the server went off to get our meals. "What made you decide to back me anyway? Everyone else considers me a bad risk."

He twirled his wine in its glass. "You've heard, I'm sure, about my 'great eccentricity'?"

"Of course," I said. Schneider never returned to Earth. Ever. All of FTI's business on Earth was handled by proxy. For seventeen years, since before the war, he had lived in space.

"You may not know why," he said.

When he paused, I grunted, encouraging him to continue.

"When I was two," Schneider said, "I was in a car accident. My right knee was badly damaged. Dad spent a lot of money on surgery, trying to have it rebuilt, but the doctors could only do so much. When I was younger I wore a brace; I couldn't walk without it. When older, I used a cane instead." He shrugged. "Here, I need neither. My knee, bad as it is, can carry me without support.

"So you see," he said after a short pause. "On Earth I'm handicapped, not as badly as some, but enough. Here and in the colonies, I'm not."

"I see," I said. "And I—"

"By most definitions you wouldn't be considered handicapped. Your reflexes are probably not much worse than the average person's. It's only in comparison to what you were before that you have a problem."

"Only." I couldn't keep the bitterness out of my voice.

"I didn't mean it like that." Schneider said. "I think I know some of what you've lost. That's the whole point."

"Oh?"

He nodded. "Low gravity gave me a second chance. I thought it might do the

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same for you."

I thought about that for a moment. My set with Brenda had already taught me a lot about low gravity tennis. It was a slower game in many ways, calling for more thought and less instantaneous reaction than tennis played on Earth. My reflexes were less of a handicap.

"It might," I said at last, then grinned. "But first, let's just worry about Bradshaw. Even Jimmy Connors couldn't play more than one game at a time."

Schneider laughed and changed the subject.

Two months of intense training put me back into shape. In that time, I learned to handle myself easily in low gravity. I could move as quickly and as smoothly as I could back on Earth. I also learned to compensate for the different ways the ball reacts to spin in the lower air pressure.

Schneider made all the arrangements for the match. Or rather, his people had. I don't think Schneider handled it personally.

All the major networks had representatives there. Live coverage. I hadn't had live coverage since the last time I'd played Wimbledon. Schneider had good PR people.

Bradshaw entered the hall while I was doing my stretching exercises. The news hounds converged on him.

"Mr. Bradshaw," I heard one of them say, "do you have a prediction for the match? I've heard you're quite confident."

"Confident?" Bradshaw flashed the camera a smile. "You could say that. I predict the match will be over in three straight sets: 6-0, 6-0, 6-0."

"That's a bold prediction, isn't it?" the reporter said. "After all, Stryker is ranked number four on Earth."

"On Earth." Bradshaw's wave took in the hall. "This is a totally different game. Also, the aftereffects of Brenberg's disease have ruined him as a competitor. It's sad, really, the way he's trying to hold on."

"So do you really intend to go through with this? I mean, if it's as you say—"

"It's not really my decision," Bradshaw said. "I'd be perfectly willing to call the match off if Stryker wished. But he insists."

"Pay close attention," Brenda whispered into my ear. "Those are the words he's going to have to eat."

I nodded. A few minutes later Bradshaw, still followed by his flock of reporters, called me to the net.

I walked slowly to the net, my feet skimming within a half inch of the court surface. I took Bradshaw's hand when he extended it.

"It's still not too late," he told me in a stage whisper that I knew the reporters could hear. "We could call this off."

I placed hands on hips and looked him up and down. God, I hated him, from the smug grin that infested his face to the idle tapping of his right sneaker against the court surface.

"Just shut up and play," I said.

The grin vanished. He nodded and returned to the baseline. I returned to mine.

Brenda had my racket and a towel for me to wipe my hands. "Remember," she said. "He's really good at ball placement. You're better with spins

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than he is, but he'll have you running all over the court."

I nodded. "I remember."

The officials took their positions. At a signal from the umpire a ball boy brought me two balls. I had first serve.

I ticked the net with the first ball. The umpire called a let.

"It's still not too late," Bradshaw shouted from his side of the court.

I scowled and tossed up the other ball. I put a spin on this serve to let me hit it higher and still make certain that it landed in.

Bradshaw returned with a strong backhand. I dove for it. The ball caromed off the frame of my racket. I never did learn where it went. Not over the net, that much I know.

The rest of the first set went that way, almost as badly as my first set against Brenda. Worse in some ways; I didn't win a game—ending the set 6-0. On the other hand, I did score a few points in most games, even forcing deuce three times.

The second set went better. I still lost—6-3—but I began to get Bradshaw's measure. He was slow in moving around the court. In particular he was a sucker for the drop shot, the one that just barely clears the net then dies.

Set three. If I didn't win this one the match was over.

"It's all over now," Bradshaw called. Never once had that stupid grin faded. And it had grown wider every time the camera had swung his way.

Bradshaw had the serve. I returned his serve and made a guess at where he would send his next shot. I sprinted across the court.

I was right. My point.

A gasp ran through the crowd as I made my point. Set three had reached 6-6. It would go to a tiebreaker.

Bradshaw stood silently on his side of the court. A slight smile played about my lips. Whatever else happened, I had shut him up.

The crowd roared. The tiebreaker was mine: 17-15.

"Are you nuts!" Bradshaw screamed at the umpire. "That ball was out! I demand the point. I demand—"

The umpire called a warning to Bradshaw. He risked a penalty.

"If you're too blind to see that it's my point, then at least call it a let."

"You were warned, Mr. Bradshaw," the umpire said. "Point to Stryker."

"What!" Bradshaw's voice rose to a shriek. He threw his racket at the umpire.

The umpire calmly ducked and said, "First game to Stryker."

Bradshaw regained control of his temper, or seemed to. He returned to the baseline on his side of the court.

I backed off the court and signaled to the umpire that I wanted a short break. The umpire consented.

Brenda brought me a jug of water and a towel.

"Don't get cocky," Brenda said. "He's angry and likely to make mistakes but you're still down two sets. He only has to win one of them to win the match."

I handed her the jug, took the towel, and wiped my hands and face with it. "I know. You want the honest truth?"

"Always."

"I never thought I'd get this far. He's better than I thought he'd be."

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Brenda laughed. "He's not ranked number one because of his charm."

I laughed back at her.

I won the fourth set, 6-4, thanks to starting with a one game advantage. The fifth, and last however it turned out, went to tiebreaker.

The score was 17-16, Bradshaw's advantage. I had the serve so it wasn't so bad.

I got off a nearly perfect serve to the outside corner of the service box. Bradshaw had to chase it down but managed a sloppy return. I grinned as the ball soared high into the air. While Bradshaw scrambled back into the court, I slammed back a forehand, using lots of topspin.

The spin caused the ball to bounce almost straight up, well over Bradshaw's head.

My mouth dropped open. Bradshaw leaped, fully twelve feet in the air. He smacked the ball back in a lovely sky hook.

As I watched in shock, the ball sailed right past me.

"In," the line judge called.

"Game, set, and match!" Bradshaw said.

I sighed and walked to the net to shake hands. "Good game."

"Thanks," Bradshaw said. "You played a better game than I thought you would."

I decided to let the left-handed compliment lie. After all, I'd played a better game than *I* thought I would.

When I saw the media surging our way, I turned to return to the sidelines. Let Bradshaw have his glory.

As I walked, I saw Brenda waving and pointing beyond me. I turned.

The reporters had gone right past Bradshaw. They were converging on me!

"Mr. Stryker, a word," one of them said.

I nodded.

"Since you've lost this match, will you retire now?"

I shrugged. "I've lost matches before." Still, I thought about it. I suppose I'd made my point. Of one thing I was certain: Bradshaw would never patronize me again. I looked down at the racket I held in my hands.

I held up a hand before anyone could ask me anything else. "Retire? Hell no. I'm just getting started." ■

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A TOUCH OF DIPHTHERIA

Roger MacBride Allen

Illustration by Steve Cavallo

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The case opens the way most of them do. I'm sitting in the bull pen at HQ, sipping a too-hot cup of coffee and pushing paperwork around. My supervisor wanders over, drops the usual one-page flimsy on my desk.

"Got one for you, Hannah," she says. "Two Vixan police officers were tracing a lead to a human-settled world named Cinder. Now they're dead. That's the sum total of our information, but we've got jurisdiction: death of peace officers, extraterrestrial victims on a human planet."

I nod. "That's us, all right. Standard brief?"

"Standard brief," my boss agrees. "Investigate in the field. Solve the murder of the Vixan police officers, solve the case they were working on."

I take a big enough slurp of coffee so that the cup won't slosh. I pull my travel bag out from under my desk, stand up, and head for the docking center, still carrying the coffee cup, watching that it doesn't spill. There's a fast courier ship available, and I take it.

I'm glad to get away from Center and dodge the paperwork for a while.

But my departure from BSI HQ is the last thing to happen quickly. Cinder is well out past Hinterland, and it takes me four days to get there, even on a BSI courier. By the time I arrive in-system, I am itching to get on with the job. But that's not the way life works. There are always reasons I can't get to work quickly. More so than usual in this place.

Cinder Orbital Control is remarkably lackadaisical about getting my courier vectored in and docked. There is a pointless delay of a half day before they can arrange a lander down to the surface. First they tell me it's a stuck landing jack, and then that a bleeder valve goes bad. I half expect that the next thing they will tell me is that the rubber band broke. I would suspect it is all some sort of strange plot to delay me, but I have spent time in lots of other backwater systems. I make it a rule never to suspect conspiracy if incompetence can explain the problem. At last the lander is at least allegedly ready to go.

Minutes before I board the autolander at Cinder Orbital a tech hands me an updated report, beamed up from the surface, on the situation. It is the first new information on the case I have received since leaving HQ.

I am glad to have something to read as I ride the lander down to the planet's surface. The lander heads downward and I split my time between the landscape and the report.

The visage of the planet is grim. My lander swings over the southern continent of Deseret. I see a land pockmarked with poisoned, discolored deserts, glass wall craters, ghost cites of ruined towers, roads that now lead nowhere at all. Mutated, virulent jungles encroach where once there was civilization.

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The Cinderites, may they all roast in hell, played at all-out nuclear war down there, some centuries back, incinerating themselves just about the time Napoleon Bonaparte took early retirement. They are gone, and good riddance, but the Cinderites left a damnable mess behind.

The view is depressing, horrifying, but it is of immediate interest to me. Down there, somewhere, is the place where two Vixa police investigators bought it, dead of radiation poisoning as they poked around an abandoned sleep ship. My job is to figure out why they were there.

At least the damned Cinderites left the northern continent alone. Greenland, the settlers have named it. It lies in the western hemisphere, across a narrow sea from Deseret. There is one other continent, on the opposite side of the globe, named Antipode, and it is as ripped up and ruined as Deseret.

I'm headed to Greenland and the planet's capital, the town of Ashville. I turn from the view out the window, hoping to find the update report more cheerful. Hell, maybe the locals have already cracked the case and I can order the lander to abort the mission and get me back into orbit.

But no such luck. I can tell at once that these locals aren't likely to solve this case, or anything else, on their own. Aside from the typos, misspellings, unwarranted assumptions, missing information, and bloody obvious leads that have not been followed up, the report is a gem of clarity and professionalism.

I sift through it all and sort out the state of play.

The alleged crime: murder.

The victims: two Vixa investigators, now on ice and probably glowing in the dark, given the way they checked out.

The weapon: The radioactivity of the planet itself. A bit of novelty there. The Vixa were lured, somehow, by someone, to the sleep ship sitting in the roasting radioactive hell of Deseret. Once they were there without protective equipment, it was all over. But how the hell could the cops have made that mistake?

The suspects: two of them, sort of. A human, Zebediah H. Hill, and a Metrannan, name of Gadzang Megtish. An interesting feature of the case: the two Vixa cops arrived *before* the two suspects showed. And yet Hill and Megtish came anyway, Megtish coming in from Metran, and Hill coming in via Hinterland.

The lander lives up to its name with a bump and a thump, and a slightly unnerving wheeze from the number three jack. Well, I made it down, and shoddy repair work at the orbital station isn't my problem.

I grab my bag, undog the hatch, and climb down on the surface of Cinder. It's a nice day, local midmorning, blue sky above. There is a green forest around the edge of the field. This part of Cinder doesn't live up to its name. I step down

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onto the heat-rippled tarmac and walk away from the lander.

Ashville Municipal Spaceport is a wide expanse of crumbly white stresscrete with a quonset hut off in the distance. I see a cheerful looking older gent coming out of the hut. He shouts "hello" at me and waves his arms over his head.

I turn and walk toward him. He is a bit below average height for a man, say about my size. He's a long-faced man, but with a wide, ready smile. He is balding, with a few wispy strands of short grey hair combed vaguely across the top of his head just to get them out of the way. He is wearing blue overalls and a checked shirt.

"Howdy," he says as we draw closer. He sticks out a hand to me and I take it. We shake hands, and I use a grip a bit more firm than is courteous. "Sam, Sam Barstow," he says. "I'm the mayor around here. You the special investigator?"

I can hear the thrill, the pleasure in his voice. He is delighted to meet a real live BSI agent. "Yes, that's me," I say, making no attempt to put any enthusiasm in my voice. I don't have the slightest patience for civilians who want to play cops and robbers. "Hannah Wolfson, Bureau of Special Investigations," I say.

"Glad to meet you," he says. He looks me up and down, sees a short, slender woman with dark curly hair, pale clear skin, and dark eyes. I can see in his face all the things he does not say in that moment. Things about how young I am, or how I remind him of some pretty young niece or granddaughter who's all grown-up now, the one he used to dandle on his knee. Wonderful. All I need on a job is some kindly old duffer putting himself in the role of father figure.

At least he has the sense not to say such things out loud. "I'm impressed. Didn't know women young as you were S.I.'s," he says, plainly happy at the chance to use the common slang term for a BSI investigator. He no doubt thinks it's a compliment to refer to my age that way.

"Oh, they have to sign us up young," I say. "We tend to die early." I make no sign to show if I'm joking or serious.

There is a moment's awkward silence, as I intended. It is unpleasant to be this rude, but it is for the best. I don't want this nice old duffer thinking this is fun, or a game. Not when two cops are dead already. "Well, ah, yeah," he says, much disconcerted. "Well look, you've got to be tired. I suppose you want to settle in and rest up. Want me to run you over to the Hotel?" Apparently, there is only one and so it does not need a name. He has unconsciously demonstrated by principle that more than one example of a class of objects is needed before objects of that class require specific names.

I know I am on edge when that sort of over-worked analysis whistles through my mind. I am keyed up after my journey, eager to get to the task at hand.

"Never mind the Hotel just yet,"

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I say, rather firmly. "I had all the rest I needed on the flight here. I'd rather get right to work,"

"Well, sure, sure," he says, still bemused. He reaches, makes a move to take my bag, but I swing my arm out of the way and hang onto it. A BSI agent carries a few odds and ends the locals don't want to know about. Besides, I don't want him to keep on treating me like his granddaughter or his niece or whoever the hell he's got in mind. If he started feeling protective toward me, it could get us both killed. Half the BSI agents that go down do so while protecting local law enforcement from whatever the hell they are up against. I walk on past him, straight for the quonset hut, forcing him to double-step a bit in order to catch up.

But such minor snubs are as nothing to him. Mayor Barstow is bulletproof. He refuses to take the hint that this isn't supposed to be fun. "Course, I'm more than just the mayor," he says, hurrying up alongside me. He is relentlessly cheerful. "Since Officer Winters quit again, I guess I'm the police too. They told me I was to provide all local assistance to you."

I glance at him as we walk, cursing under my breath. If this nice old man is the sum total of local law enforcement, things are bad. "Were you the one who wrote the case report I got just before landing?" I ask after a moment.

Barstow nods proudly. "Sure did. Worked like crazy on that thing. It tell you what you need to know?"

I am about to light into him, go into all of the report's many and serious faults, but then I don't. It is pointless to chop him down that deep. He'll never need to write a crime report like that again. What point in rubbing his nose in it? "You did just fine," I say, surprising myself with the gentleness of my own voice. He is clearly pleased.

The quonset hut is long-side to the landing field. There are two doors, at either end of the side facing the field. One is marked DEPARTURES, the other ARRIVALS. Through the windows that run the length of the whole building it is clear that the interior is one big room. Classic. Are the signs a local joke, or is the spaceport run by some tightly wound bureaucrat who insists that travelers use the proper doors at all times?

Barstow catches up with me and leads me towards the ARRIVALS door, thus tending to confirm the latter theory. He pulls open the door for me, and we walk into the building. A severe looking matron sits behind a counter inside and glares at us, the archetype for all the librarians ever scandalized by patrons who dared to disrupt their orderly domains by checking out books. A withering stare from her is all the clue I need to know that my unscheduled landing has thrown the proper operation of her spaceport into chaos.

She clearly expects me to go to her, show my papers, flash my badge, and go through the local rigmarole, but I do not even break

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stride. BSI agents do not, repeat not, go through customs on human worlds. I head for the door on the far side of the building, to the woman's obvious indignation.

Barstow feels obliged to smooth things over. "See you later, Martha," he says, nodding to her. She does not deign to respond. I step through the far door and out into the daylight.

Barstow's car is waiting. It is an off-road vehicle bought off some mining operation, here or on some other world, a huge jeeplike thing, all roll bars and shock absorbers, painted a gleaming white, lovingly maintained. We climb in.

"OK," he says, "Where to? You want to go interrogate the suspects first?" It would seem he has gotten the message that he is to treat me seriously, though there is an undertone of irritation as well. So be it, if that is what it takes to keep him safe.

"No," I say. "Usually I would, but hell, we don't even know if they committed a crime—or if there was a crime committed. Maybe the two Vixa cops wandered off on their own, got themselves killed without outside help."

"I doubt it," Barstow says. "Not from what Bobby Winters said."

"Bobby Winters? Officer Winters?" I ask. "I thought you said he was off the force, that he quit."

"He *was* the force until he quit," Barstow says. "See, most of the time, there just plain was nothing for him to do, and Bobby felt bad taking money for doing nothing. So he quit—but when police things come up, he still sort of takes care of them, kinda like a free-lancer."

"I see," I say, although I don't. "What does he do now?"

"Nothing much. He just hangs around the municipal building and collects unemployment." Barstow pauses for a minute and thinks. "Come to think of it, that's not much of a change."

"Not really," I agree. "But maybe we ought to go see him."

Barstow nods and hits the accelerator—and hits it hard. My head snaps back as we rooster-tail away toward town, leaving a cloud of dust behind.

The drive into town is a wild, jouncing affair, over a wild, potholed track that barely qualifies as a road. The mayor's much-loved vehicle handles it without much difficulty, but I find that I am hanging onto the frame for dear life, quite glad of my seat belt, wondering how easily this model of a mining car rolls over. I glance over at Barstow. It is plain to see that he is enjoying himself—at least partly at my expense. He is pleased at the chance to throw a quick scare into the uppity BSI agent who landed in his town with her nose out of joint, but he also enjoys the ride for itself.

We rush along the winding road, through deep forest and open plain. It is not a long ride, of course. It is plain that the good people of Ashville located their spaceport as close to town as possible, or rather vice versa. Usually it is the space-

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port that gets built first in these outpost worlds. Then they put the town just outside the crash-danger circle. If Ashville ever grows much —though that seems unlikely—there will be problems.

But they won't be mine, thankfully. Life on a backwater world is not for me. It always amazes me that a place like Cinder manages to survive. The countryside here around Ashville seems pleasant enough, but I know from the backgrounders I read on the way that even here, thousands of kilometers from the devastation of the other continents, they have to be careful. If the winds blow the wrong way, and kick up dust from the nuclear deserts, the very rain can be radioactive. Fortunately, that happens but rarely, and the people here know how to take precautions. They dare not eat ocean-caught fish, for example, or game birds that might have overflown Deseret. They can survive—and even thrive—if they do it all right. But it seems no way to live, no place to raise children.

And yet it is a good place. That I can see as we drive along. The air is sweet, the sky clean. The plant life may be overly lush in places, strangely warped in others, even to my unpracticed eye, but this cruelly punished land maintains its beauty.

And that is the secret, the explanation.

I know all the long explanations—any living planet, any bioworld, even one so crippled as this, is a jewel beyond price. It can serve as a waystation for starships, extending their range. It can provide food, medicines, a port in a storm. A world can take on a thousand refugees from a crippled spacecraft. No orbital habitat can do that. Those are the cut-and-dried reasons, the cash-and-carry reasons that people offer to explain why they would come here to live.

But the real reason is there in Mayor Sam Barstow's eyes, as he looks over the lush, crippled landscape and then catches me looking at him. He smiles and tells me what I already know.

"God, I love this place," he says. "No place else I'd rather be."

Our species' capacity for that sort of damn fool irrational love for the orphan places led us to possession of all the Cinders, all the little lost worlds out among the stars. I think of the glowing deserts on the other side of this world. The Metrannans, the Vixa, the Stanlar Consortia—none of them, indeed no other race but ours, would ever invest part of its collective heart in such a heartbreaking place. I do not know if that is our weakness, or our strength.

Enough philosophizing. I wedge myself back in the seat and force myself to look at the scenery without thinking.

We pull into town, and stop in front of a scruffy-looking building whose white-pillared portico has never fooled anyone. ASHVILLE MUNICIPAL BUILDING it says over the door in weather-beaten letters. I make a bet

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with myself that half the upper floor is vacant. Even the most modest of effort smacks of delusions of grandeur in Ashville.

Barstow undoes his seatbelt and jumps down from the seat. I hop down after him. I am about to follow him into the building when he touches me on the arm and nods, indicating two figures strolling down the avenue. "There they are," he says. "Hill and Megtish."

I look and see a tall, dapper, handsome human male, arm in arm with a Metrannan.

Hill is dressed in the latest of old-fashioned looks, all the rage back at Center. He is a tall, elegant, slender man in a blue and white seersucker suit that fits him like a glove. His white shirt is immaculate, set off by what looks rather like a school tie, though I do not recognize the pattern. His hair is jet-black, cut rather short, combed to perfection, gleaming in the sunlight, every hair in place. His eyes are blue, and twinkling, his skin pale, his face rather long and lean. He is clean shaven, but with a slightly over-small, over-precise jet-black moustache. He wears a smart looking straw boater, set at a jaunty angle.

His companion, Megtish, is a grizzled old Metrannan dressed in a smart looking red kilt that sets off his greenish-grey fur to advantage.

Old. That is a key point to register. I have never seen such an old Metrannan. They rarely live past forty Earth years. But judging by the full, lush grey of his ruff, this one is nearly that old already. His step is not firm, his eyes seem a bit filmy. It is said that the Metrannans are obsessed with the brevity of their lives, insanely jealous of the races that live far longer, and, looking at Megtish, I can believe it. There is something angry, impatient, about him. What is there in the sleepy world of Cinder to draw him here in the fast-gathering twilight of his life?

Megtish is of average build for a Metrannan, about a meter and a half high, stockily built by human standards. His head is big and bluntly round, his ventral, or forward, eye-pair big and slightly pop-eyed. As best I can see, his dorsal eyes are shut, no doubt out of courtesy to the local humans who would be disconcerted by two beady eyes staring at them from the back of his head. He has a disturbingly human looking smile on his wide, thin-lipped mouth. If it is meant to set humans at ease, that smile is a failure. If it is intended to unnerve, it works quite well.

His lower pair of arms are folded together against his chest in imitation of the human gesture. His upper right arm rests in the crook of Hill's left elbow. His left hand holds a handsome walking stick, the twin of the one Hill bears in his right hand.

They see us and turn toward us, moving at an easy pace down the uncrowded street, though the stares of all the townsfolk are centered on our encounter. When they are close enough, Hill disengages his arm from Megtish's and lifts his

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hat to me. "I presume that our redoubtable investigator has arrived," Hill says. His voice is polished and refined. "I am so glad that you were able to come so far to resolve our trifling little problem." He offers his hand and I reach out automatically to shake it. Instead he leans over my hand and kisses it, a dry, chaste touch of the lips. "My name, as you are possibly already aware, is Zebediah H. Hill, and this is my associate, Gadzang Megtish."

"Charmed, I'm sure," Megtish volunteers in a throaty, guttural voice. He coughs wearily.

I get my hand back and regard the two of them. "Hannah Wolfson, BSI," I say, determined to not get entangled in the absurdly old-fashioned attitudes and manners that were already getting tiresome in some parts of town back home.

"Megtish and I were taking our morning constitutional," Hill says. "Unless you have more pressing matters, you are certainly welcome to join us."

"No, thank you," I say. Not bloody likely. I have no desire to question these two in the open air, in public.

"Ah, well then, until later."

"Yes," Megtish says. "We are both eager quite to solve the situation, are not we, Zebediah?"

"Quite so, old boy, quite so."

Hill tips his hat to us again and they are on their way. I am put on the alert by the pair's old-world courtliness, their courtesy toward each other. There is something it should tell me. It is a warning flag of something, but I do not know what.

"The buddy-buddy bit is an act," Barstow says, quite needlessly.

"A bizarre one," I agree. I could sense the tension between the two of them. "Why do they do it?"

"They seem to feel the need to keep up a united front. And they are almost never out of each other's sight. I think they're keeping an eye on each other. They're out together every day, throwing their money around, doing everything they can to charm the townspeople."

"Hoping to get a friendly jury in their pockets?" I ask. "That's planning awfully far ahead when they aren't even charged with anything."

"Or maybe they'd settle for a confused jury, full of folks saying such nice fellows couldn't have done any such thing. All they need to get is reasonable doubt."

"Well, they better not count on it being a local court," I say. "BSI, the Center, the Vixa—we've got so many possible jurisdictions it's almost hard to choose. Those two must know that."

"Still, it might be worthwhile for them to cultivate the locals," Barstow shrewdly observes. "Witnesses, local sympathy, a few friendly souls who might feed them a little back channel information."

"It is working?" I ask.

"With some folks. But most of us just take their money and don't pay any mind."

I file the fact away. An active, efficient rumor mill can be a useful thing. "Might I ask why they aren't

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in custody?" I ask.

"I suppose I *could* put 'em in the slammer, but, well, like you said, they aren't charged with anything—yet. And we're not much for locking people up around here. We all came here to Cinder so we could get some elbow room. Besides, I've made darn sure everyone in town knows to keep their cars and aircraft locked down. Even if those two got hold of any transportation, there's nowhere to go anyway. If they drove off into the forests they'd starve. If they drove to one of the smaller towns, we'd just pick them up there. If they flew to Deseret or Antipode, they'd die of radiation poisoning. They sure as hell can't steal a spacecraft, and even if they could, nothing on the planet could get them farther than Cinder Orbital. What good would that do them?"

There are holes in this logic, flaws in this security, that I could drive a truck through. After all, the Vixa cops died while examining a spacecraft, one that for all I knew could easily get itself past orbit and into free space. But neither of these two have gone to it yet. And while I would bet that a skilled, well-paid pilot could slip a ship past Cinder Orbital with no trouble, I note they seemed in a rush to get here, while they are in no apparent hurry to leave. But what reasons do they have for being here?

I follow Barstow into the Municipal Building. We snake through a labyrinth of scruffy corridors and offices that seem to be used as storage space. At the rear of the building, Barstow leads me down a set of stairs into a musty cellar. I make my way down a set of slightly rickety stairs and find myself in the Ashville jail, such as it is.

The room is poorly lit and it takes some time for my eyes to adjust. I see a bare cage, a cell of iron bars, in the far corner of the room. Barstow walks to the cell, pulls open the unlocked door, and crosses to the cot. There is a man asleep on it, and he gives the man a poke. "Bob! Hey, Bobby, wake up! Lady here to see you. Lady from the BSI."

Officer Winters mutters and grunts, then rolls over to look at Barstow with a look of blank incomprehension, as if he could not remember who Barstow was, or even who he himself was. Then his mind wakes up, he blinks, and comes to himself. He sits up on his elbows and looks at me. "You from BSI?" he asks, still sleepy.

"Yes," I say, crossing the room and entering the cell. He swings his feet off the bed and sits up. He is wearing some sort of rumpled and rather seedy light brown uniform. "Mayor Barstow tells me you're the man I should talk to about the dead Vixa."

Bob looks up at me, his sallow face in sore need of a shave. He grins and laughs, and I get a strong whiff of the alcohol on his breath. "Yeah, I guess I am," he says. "Whaddaya want to know? Wanna see 'em? Got 'em on ice over at the meat packing plant." He yawns and rubs his head.

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The idea is not very pleasant, and besides, I am no expert on dead aliens. I sit down on the cot next to him. "No. I just want to know what they were doing here."

"Well, the Vixa came in last Tuesday, and started asking around. Then Hill arrived on-planet Wednesday, and Megtish came in on Thursday. By Friday the whole town was full of rumors about how there was this ship out in the middle of Deseret, and it was full of cash, or diamonds, or gold. Everyone had the ship full of something else, but all the stories said if you got to her first, you were rich. Except for the radiation, of course. What good are radioactive diamonds? The Vixa flew their own ship out to get a look before anyone could stop them. Their ship's still out there, in fact. No one could work the Vixa controls."

It's a detailed answer, yet it doesn't clear up the question I asked. I try again. "But if the Vixa were tracking these two, Hill and Megtish, what were they doing here *before* the bad guys got here?"

"Simple," Barstow says. "The Vixa weren't after Hill and Megtish, least not at first. The Vixa were investigating that big land purchase. But they got plenty excited when Hill and Megtish showed up, saying they were looking into the land swindle for themselves. It was their company that got taken."

I look up sharply at Barstow. "Land swindle?" This is the first I have heard of any such thing.

"That wasn't in my report?"

"No," I say, in my coldest voice. It is all I need to say. Barstow knows he has screwed up.

He is leaning up against the bars of the cell, and shifts uncomfortably. "Hell, I thought I put that in there. Well, anyway, 'bout a year ago, this fellow representing some outfit called Cinder Land Enterprises bought a huge tract of land right in the heart of one of the worst radiation zones. Bought it real cheap from the planetary government. Seemed strange to us. But the land isn't worth nothing, just another patch of hell, and we didn't mind taking their money.

"This fellow put out some crazy idea that radioactive land was the ideal long-term investment. Buy cheap, wait five hundred years for the radiation to die out, and then put in a golf course, or something. We didn't buy that of course, but like I said, they were paying good money. Next crazy thing is this construction company shows up and says Cinder Land Enterprises has hired them to build a spaceport to provide access to the site. They flew in all this hardware and started construction there. They were busy as hell for a while. Then they said they hadn't been paid, and they pulled up stakes and quit. Then, a few months after *that* this outfit Interworld Transactions paid damn big money for the place."

A standard land swindle, it sounds like. Buy land cheap, make phony improvements so you can show receipts and good will, then find a sucker and dump the land.

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"Megtish and Hill work for Interworld," Barstow goes on. "They claim their outfit didn't authorize the purchase. Each of them says he got a memo from the front office and came here to investigate without knowing the other was on the way. Didn't I mention any of this in my report?"

"No," I say, trying desperately to keep my temper. Suddenly the whole case has changed.

"Sorry you didn't know this stuff," Barstow says. "I coulda sworn I told you. The land deal's been such big talk around here I guess that I assumed everyone knew."

"Any idea who started the rumors about a ship full of diamonds?" I ask.

"It stands to reason Hill or Megtish touched it off, on purpose or by accident. But which one, I dunno. And if they did plant it on purpose, I have no idea which version of it was theirs, or why they did it."

"Did the Vixa cops have any interest in seeing the ship before Hill and Megtish got here?"

"Nope. All they were interested in was information on the deal for the land the ship was sitting on."

It is a major effort of will not to bite Barstow's head off. He must have had most, if not all, of this information when he first sent a shout for help to BSI HQ. Why the hell didn't he give us the full particulars? I could have spent the trip here studying up instead of staring at the bulkheads.

But, once again, there is no reason to tear into him. What good would it do? Besides, I know the reasons why his message was so short. First, hypersignal is damned expensive. And second, that's all anyone ever signals to BSI HQ in the videoshows. I find something diplomatic to say instead of yelling at him. "You've got a nice little tangle," I say. "But what was it to the Vixa if there was a suspicious land deal on Cinder?"

"I never quite understood that," Officer Winters admits. "They didn't speak real good English. Real heavy accents. They gave me a real fancy datapack they said had all the info in it, but hell, I couldn't make head or tail out of it."

"I'd like to get a look at that pack," I say.

"Sure," he says, "I got it in my desk somewhere."

He stands up, a bit unsteadily, and makes his way out of the cell and across the room to his desk. The desk is buried under a stack of old paperwork and miscellaneous junk. Bob burrows around for a minute and comes up with a datapack bearing the subdued, tightly worked scrollwork of the Vixa police logo.

I take it and shove it into my pocket before Bob has a chance to think whether he should offer to let me have it. Maybe he just intended to let me use it in his office, in his presence, but Bob does not strike me as the sort of person I want controlling my access to information. He seems about to say something

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but then decides not to argue.

I change the subject to keep him off balance a bit. "This fellow who came through and did the deal for this Cinder Land Enterprises operation. Human, I take it? Human male?"

"I dunno. Never saw him," Bob says.

"I met with him," Barstow says, "But I tell you right now that I wouldn't know that CLE guy if I tripped over him. He gave me a name, but I bet it wasn't his. Wrote it all down somewhere. Blond hair, a beard, wore sunglasses. Besides, it was a while back, before all this other stuff happened to make it stick in my mind. He just delivered the documents, handed me the check, and we never saw him again."

"And he never went out to look at the land."

"Not so far as I know."

This is very odd. A man in a fairly obvious disguise shows up to do a job he could have done by hypersignal, no sweat. So why come, if coming was risky enough that he had to put on a beard and wear shades? To me, it suggests that the trip was a cover for something else.

I decide to pursue the question later. "Clear something else up for me," I say. "Megtish and Hill. What the hell are they doing here? How do they fit in? They came in from opposite sides of the sky, showing up *after* the Vixan cops. The cops wanted to arrest them. What are they to the case and each other?"

Bob tries to explain. "Hill and Megtish say they are here representing Interworld, looking into the land deal they got taken in by. The Vixa said they were part of the swindle, and part of something bigger, something there was no Vixa word for," Bob says. "They said there was just an old Earth term. They said Megtish and Hill were on the same tag team."

"*Tag team?*" I ask. "What in God's name is that?"

"It's a kind of wrestling," Mayor Barstow explains. "Real old, but awfully popular here. We get feeds off the comm nets. It's sort of team wrestling. One guy jumps in and takes over when the other gets into trouble."

"I just figured the Vixa meant they were partners," Bob says.

"But why the hell would Vixa use an analogy to an obscure human sport, rather than just say 'partners'?" I ask. "I speak a bit of Vixa. They have a word for 'partners.' It's not an alien concept for them."

Bob shrugs. "I dunno, lady. I'm just telling you what they told me."

Bob, I conclude, is not much use as a witness. I turn to Mayor Barstow. "I'd like to have some time to myself to go over the datapack," I say. "Then I want to talk with Megtish and Hill."

"One by one or both at once?" Barstow asks. He scores some points, for this is an astute question. Will I get more out of them by using each to set off the other, or will it be more useful if I split them up so they have no way of keeping their stories straight? I think for a

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minute. They have had days with not much to do but work up plausible answers, and judging by their behavior this morning, they are likely to have their stories well rehearsed. "Together," I say.

"Good," the mayor says. "We can all have dinner together tonight at the Hotel. Get them relaxed over a meal and maybe you'll get more out of them."

I'd rather have the two of them in a steel cage and sweat them for an hour or two before I start questioning, but I suspect that would be hard to arrange.

There are a thousand more important questions to deal with, but there is a point of cosmic insignificance that has been nagging at me. "One last thing," I say. "You say you don't like locking people up, and there's no need to do so because no one could get away anyway. If you don't lock up when you have them, why do you have a jail in the first place?"

Officer Bob and Mayor Barstow look at each other blankly. Clearly the question has never occurred to either one of them before.

At last Bob answers me. "Well, shoot," he says. "If there wasn't any jail, where would I sleep?"

Mayor Barstow smiles and nods in satisfied agreement. He accepts this logic.

Small town life in a backwater world. Strange. Very strange.

It is no particular surprise to me that Mayor Barstow is also the proprietor of the Hotel. It also occurs to me that he had a slight financial motive in allowing the two offworlders their freedom. Given the choice between two prisoners cared for at taxpayers' expense, and two paying guests at his establishment, it probably wasn't even a contest.

The Hotel is a genteel-shabby establishment, wooden, two stories, its greyish-white exterior in need of a coat of paint. I get checked into my room without too much ado and sit down at the slightly rickety desk to get on with my work.

I take out the Vixa datapack and power it up.

But it is not the dead Vixa, but the live human and the elderly Metrannan that occupy my mind. What is a Metrannan that old doing out here? I find myself running through the basic facts of Metrannan life in my mind.

By any standards at all, the Metrannan life span is tragically short, at the longest about forty Earth years. Even that is a doubling of what it once was, before technology brought improvements in sanitation and medical care. Humans are short-lived as well, compared to the three or four centuries a Vixa can expect, or the thousands of years the average Stanlar Consortium is functional. But no race dies as young as the Metrannans.

Metrannan technology, on the other hand, has been incredibly stable. Metrannans were using spatial interstitial power sources back when Cheops was raising his pyramid—but you could swap parts be-

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tween power units made today and those of six thousand years ago. Their engineering is incredibly conservative. There has been no real technological advance among them—or among any of the other star races—since about the time of the human invention of agriculture.

Given technological borrowing from other races, and our own R&D, our people project that humanity will surpass Metrannan technology in about another 150 years. Or else we will get bogged down into the same sort of racial inertia that seems to have overtaken all the other races once they were out among the stars. No human believes that is going to happen, of course, but the other races are watching for the signs, with something approaching amused and mild interest.

On to the datapack. I rummage through my kit for the proper adaptors and plug it into my Data-Viewer, plug another tap into the room's comm line, linking me to the local datanets as well. I am expecting a fairly straightforward police report on the land deal, but I get another surprise instead.

Both Hill and Megtish have police records as long as my arm. They are con artists. I kick myself mentally. I should have thought *confidence man* the moment I saw the overly careful way Hill talked and dressed. *That* was what my subconscious was trying to tell me. No one but a man who made his living lying would put as much effort into a sincere appearance. I skim the Vixan information. Some of the reports are outstanding warrants, but mostly the reports say they have often been suspected, yet rarely caught. Proof has been hard to come by. Still, there are quite a few places where they will not be welcome back under the same name as the last visit.

There is a part of me that is pleased to discover the con angle. Murders are grim, hard business, and there are two dead bodies in the morgue; my fellow law enforcement workers cut down by a horrible death. And yes, con artists are thieves. Hill and Megtish have no doubt wiped out more than a few life savings, ruined more than a few lives, perhaps induced a suicide or two.

But there is something about the cunning, the nerve, the skill, the *artistry* of a first-rate con artist that will arouse at least grudging admiration in even the most upright and honest of people. As I read through their case files, I find myself looking forward to dinner with them, and understanding why Mayor Barstow thought a dining room to be a better venue than an interrogation room. A certain roguish charm shines through, even in their police records.

In my part my admiration comes from the obvious pattern to their frauds: they have lied to and cheated those who most richly deserve it.

Every sort of game, simple and complicated, new or old, that the greedy might fall for—these two,

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working together and working solo, have at one time or another played them all, against all sorts of dishonest high rollers. They seemed, however, to have a fondness for hollow companies, huge, busy operations that grew fast and then collapsed into nothing at all just after the eager and deluded investors had dumped their last dime into them, at the exact moment Megtish and Hill were cashing in and catching the next starship heading anywhere.

And that brings a thought to mind. What was the angle on that land sale? How is it that a company run, at least in part, by two con artists would *buy* worthless land? It did not make sense. I burrow through the datapack, the DV skillfully extracting information on the topic in question.

"Prime Spaceport Site," is the first phrase that pops into view. I read over the document the DV has captured. It would appear to be a glowing description of the land in question. "Facilities in place," "Outstanding long-term investment," "Superb growth opportunities on the cutting edge of the human space frontier."

Standard con-artist guff, all of it. A racket at least as old as submersible Florida acreage or the Brooklyn Bridge or prime farmland for a song in the Ukraine. How could two old confidence tricksters have fallen for the spiel they have given out themselves a million times?

I focus on the facts at hand. CLE buys the land from the public domain and then resells to Interworld transactions, which is partly owned by Megtish and Hill. Who is Cinder Land Enterprises, and why did CLE bother? They earned a profit on the sale, but not so much that it merited the bother—and risk—of such an elaborate swindle. On a hunch, I use my BSI overrides to check on the status of CLE's local account. It is a secret numbered account, owner unknown. That much does not surprise me. Loose banking laws are a tradition on the backwater planets.

But then I swear under my breath. The payment for the land is still sitting there in the account. Any self-respecting con artist worthy of the name would have cleaned out that account immediately and gotten the money offplanet, or at least transferred it to a non-traceable account before the purchaser could discover that his nice new spaceport was radioactive. Why the hell was the money still there? Its continued presence violated every rule of running a con.

A very strange idea occurs to me. Whoever sold that land was not a legitimate con artist. The owner of CLE was merely *posing* as a con artist.

But what of Megtish and Hill? What of *their* current dealings? I notice that their police records end at about the same time, three years ago. But I know con artists, and it is unlikely in the extreme that these two have gone straight. There is a thrill to the big con, and it is ad-

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dictive. I seriously doubt that these two would give it up willingly. Either they have, out of need, scaled down their enterprises, or else, out of desire and ambition and the need for a thrill, they have gone after bigger cons.

But the small-time grifter leaves a constant trail of small-time trouble in his wake: petty fines and arrests for petty offenses. Big timers are arrested for bigger cons at rarer intervals. There is an inverse relation between the size of the con and the frequency of arrest.

These two have left a clean pair of heels for three years. Therefore, they have moved on to bigger things.

I move on through the datapack. Three years ago, Megtish and Hill joined the board of Interworld Transactions, whose board of directors represented most of the major starfaring races. Good, solid, safe investments, the basic meat and potatoes of interstellar commerce. All very above board, other than the fact that Hill and Megtish parlayed a series of forged credentials and phony bank accounts into seats on the board. But after that, it at least *seemed* as if they were keeping their noses clean.

Until the directors started dying.

My stomach ties into a knot. I have been almost accepting of the idea of a con man playing a game, cheating the thieves, giving the greedy what they deserve. But this file accuses them of murder. Cold-blooded, methodical, multiple murder.

It was the death of the three Vixa board members, two years ago, that launched the investigation. One dead of food poisoning, the other two suffering sudden circulatory arrests. All listed as unfortunate accidents. It was not until the rather leisurely Vixan laws of wills and inheritance had worked their way through the estates that anyone thought to connect the three. But an alert tax official discovered that all three dead Vixa had made wills naming their business partners—to wit, the surviving members of the Interworld Transactions board—as the only beneficiaries.

But most of their fellows on the board had not lived long to enjoy their rewards. Four more board members suffered accidents. Two humans, a Metrannan, and a Pavlat. Intriguingly enough, the two humans died on Hinterland, both in cryogenic accidents. The Metrannan reportedly died at the advanced age of thirty-seven Earth years. The report in the datapack allowed as how that might actually have been death by natural causes. The Pavlat, however, was shot dead in broad daylight in the Little Pavlavia section of lower Manhattan, a professional hit. Of course, to some New Yorkers, that too might be regarded as death by natural causes.

Distance and poor coordination between police organizations had served to prevent any but the most relentless investigator from making the connections between the deaths. That, and the fact that Interworld Transactions was itself

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well hidden, working through a dizzying maze of dummy companies, the names of its officials kept secret. No wonder Officer Winters could not follow it all. I am trained to deal with such matters, and I am having problems.

But then, two weeks ago, the Stanlar Consortium Uthgar sent a majority of its bodies to pay a visit to Vixa.

The Consortium Majority's personal starship arrived at Vixa with every molecule of air pumped out into space.

No real trace of how it was done, but the best guess was booby trap software loaded into the environment system sometime in the past. Anyone who had ever been aboard—a list that included the entire Interworld board—could have done it.

There were insufficient undesignated bodies remaining on Stanlar to sustain the minority of Consortium bodies left behind. The Consortium Uthgar died.

There is nothing unusual in the death of a Metrannan, or a human, or even a Vixa. But Stanlar Consorts remain intact so long that when one dies it is headline news. The Consortium had died in Vixa jurisdiction, and the Vixa police, fearful of angering the Stanlar, went ballistic. When they discovered Uthgar had been on the board of Interworld Transactions, and linked Uthgar's death into the ongoing investigation, ballistic no longer described their reaction. Even now, there were teams of Vixa investigators on every world even remotely connected with the business.

Suddenly I make the connection. What was it Officer Winters had said? Tag team? In a sense that is accurate. Any member of the team who got tagged was dead. But there is another word, an old word, a word that would sound like "tag team" through a thick Vixa accent.

An obscure human term for which there is no translation.

I burrow through the contracts signed by the directors of Interworld Transaction, and I find the clauses I am looking for. Yes, new board member contracts, drawn up and signed some time *after* Megtish and Hill joined. As with the Vixa who had died, the contracts served as new and valid wills, with the signatory naming the surviving members of the board as sole beneficiaries, the proceeds to be divided equally. With each death, the survivors would inherit larger and larger shares. No doubt the longer-lived Stanlar and Vixa had all seen the new clauses as being highly profitable—if they paid them any mind at all. No doubt the Stanlar viewed the clause the same way a human would regard a contract clause that involved the results of being hit by lightning. Death was so far off for them that it must have seemed inconceivable that some upstart humans and Metrannans might outlive them. . . .

Hold it. I stop. I think.

And then it comes to me.

I have it all. Thirty seconds before I did not know the question, but

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now I knew the answer. And I know what to do. A plan pops into my head, almost of its own accord.

I think it all out carefully, run over the details in my mind. Yes, I can manage it all. Except there is one thing that needs checking, and I would have trouble getting the information myself. I switch on my comm unit and call Officer Winters. He is an uncertain ally at best, but certainly he can do this simple a job. After a certain amount of hesitation, he agrees.

It is going to be an interesting dinner.

I give up on the clothes I brought with me, and rush through a shopping spree in the town, trying to ignore the stares of the frankly curious townsfolk. I can hear the whispers behind me. A BSI agent adds the last touch to the wild scandal playing itself out before them.

I am pleasantly surprised by the quality of merchandise on sale, and horrified at the prices. My expense account on this job will be hard to explain. But my appearance will be important tonight. If I show up as a frumpy field operative, Megtish and Hill will dismiss me. If I look the part of an elegant and sophisticated woman, someone capable of intrigue, they will take me seriously. They *must* take me seriously, if they are to fall into my trap.

I choose a long black strapless gown, velvet, cut low and showing far more decolletage than I ever would dream of doing within a hundred kilometers of BSI HQ. The waist is gathered high and covered with a dark red band. By the time I am done shopping, it is nearly time for dinner. I return to my room and dress hurriedly. I do my makeup and then put on the one piece of jewelry I chanced to have stuffed in my travel bag when I left BSI HQ. It is a gold chain necklace with a bright and perfect synthetic emerald hanging down.

I leave my room and head down the slightly rickety stairs and into the dining room. The mayor and our two suspects are there already, and they stand as I approach the table. Hill hurries to pull my chair back. I take my seat and the others sit down.

The two men, Hill and Barstow, are in evening dress. Barstow's black dinner jacket is a little musty and frayed about the edges, and his tie a bit worn and shabby. Hill, on the other hand, is sartorial perfection, his jacket jet black, the shirt gleaming white, and his cummerbund matching his tie.

Megtish is scarcely less splendid. He wears a long flowing robe of a silken yellow fabric, a pattern of red and white rectangles worked into the robe's cloth. His fur is combed back, and every hair of his ruff is in place. I note that his dorsal eyepair is open now, and watchful. Perhaps that is a reflex of understandable paranoia when a con artist sits down to dinner with a cop.

An elderly waiter begins to serve, and from beginning to end of the meal, I have no idea what is set before me. My mind is on other things

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besides food. I key off of Hill to be sure I am using the proper fork, and eat it all.

We are the only guests in the Hotel, and the only ones dining here tonight. The large and empty dining room, full of darkened corners, echoes to the clatter of our cutlery and the whisper of our small talk. By some sort of unspoken agreement, we do not discuss the case during the meal. Instead Hill regales us with all sort of fascinating talk on art, music, the sciences, nature. It is impossible not to be caught in the spell of his words, hard to remember that the Vixa believe these two have killed again and again.

Some things I have noted. Megtish speaks only halting English, little more than a few stock phrases. Hill is often forced to shift over to Metrannan in order to explain this point or that. This does not surprise me, as Metrannans are reputed to be as bad with languages as the Vixa.

Dinner done, it is time to talk business. I pour myself a small glass of wine and turn toward my two charming suspects. "Tell me," I say, "what exactly possessed you to form a tontine when the other members of the board were likely to outlive you by thousands of years?"

I watch carefully. Hill and Megtish are surprised. That is clear in their reaction. Hill's eyebrows shoot up, Megtish's dorsal eyepair open panic-wide. But it takes only the most fleeting moment for them both to recover their composure. They manage it so fast that I would never have been sure they had reacted if I had not been watching carefully.

"Tontine?" Megtish asks blandly. "What's that?"

Mayor Barstow is distracted, muttering to himself, trying out the sound of the word. Then his eyes light up. "Tontine! Is that what the Vixa cops were saying? Not tag team, but tontine?"

"Precisely, Mr. Mayor. An Earth term for a concept that has no Vixa equivalent. I would venture to guess, however, that it is one term you understand quite well, Megtish."

"I have heard it never before," Megtish replies, using three of his hands to fiddle nervously with his wineglass.

"Nonsense," I say.

"Well *I've* never heard of it," Barstow says. "What the hell is it?"

"A tontine is a group arrangement wherein each member arranges his will so as to leave all his worldly possessions to the survivors. As each member of the tontine dies, greater and greater wealth is divided up between fewer and fewer people. In the present case, these two were rather secret and quiet members of the Interworld Transactions board. There were ten original members of its board of directors. As each died, his, her, or its wealth was divvied out between the other members of the board. When Stanlar Consortium Uthgar was killed two weeks

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ago, the Consortium's service computer followed its programming and transferred the ownership of all its accounts to these two gentlefolk here. The Consortium's third share in the prior inheritances, and its own substantial wealth, were divided between Hill and Megtish. Ten members of the tontine to start, two left."

"Are you accusing us of murdering the other members of the Interworld board?" Hill asks coldly.

"Yes, of course," I say. "Based on the evidence collected by the Vixa. There are one or two details to firm up, but nothing significant. The Vixa investigators did a fine job tracking down your partners. They were a rather far-flung crowd. That must have made it easier, in a way. One death on Earth, another two on Hinterland, a spot of bother on Vixa, a mishap in space—who is to connect them all? And of course your fellow board members were not only rich, but dishonest. You knew that none of them was likely to go to the police about a suspicious death that made them richer. And I bet you were careful not to bring too much attention to the tontine clauses in their contracts, either. Maybe some of them didn't really get the idea at first. Not until the first couple of inheritance payments came through."

Hill looks at me carefully. "I see that your predecessors did indeed do their work well," he says. "We can't deny that our partners have met a series of unfortunate fates. But we were not responsible. It would be daylight madness to think no one would notice the death of a Stanlar Consortium that should have lived another two thousand years. We cannot be held to blame for the terrible accident that took its life."

"Desperate people can do things that are quite mad." I say. "And don't call Uthgar's death an accident when the method of sabotage has already been established." This is a lie. No one knows how it was done. "And I can't help but think that the fact that two of your partners had died in cryogenic failures is suggestive. They try to cheat you by coldsleeping their way past your lifetimes. You cheat them back by pulling the plug. Maybe it wasn't even you two who did all the murders. Maybe *all* the members of the tontine were busy picking each other off, growing more and more desperate as the field thinned itself out.

"The first deaths looked like accidents—but shooting the Pavlat and sabotaging the Consortium's ship seem a bit unsubtle, a little rushed and panicky. Especially when there are only the two of you left. It limits the suspect list a bit—and, I would guess, makes the two of you rather careful around each other. Still, it must have been tempting when the Consortium was richer than the rest of the tontine put together."

Hill clears his throat a bit nervously. "I must once again deny any part in these deaths. But might I ask what this has to do with the death of the officers you were sent here

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to solve? The case that has forced upon Mayor Barstow the unpleasant duty of holding us here against our will?"

"Oh, it has everything to do with it," I say.

"But we thousands of miles away, just on the planet arrived, when they died!" Megtish protests. "I here get of all last!"

"If you are capable of arranging a Stanlar Consortium's death in deep space and hiring a New York hit man, then I see no difficulty in the present case. Besides which, there is the matter of how the Vixa police officers died. A very strange way to die, in this day and age."

Hill glances nervously, almost involuntarily, at Megtish, but he does not speak.

I finish my wine and put down the glass. "I think, perhaps, gentlemen, that concludes our evening together. There is a word or two I wish to have with the mayor. I trust you will be available if I need to talk with you further."

Hill and Megtish exchange glances as they stand up. "Where we got to go?" Megtish asks rhetorically. The two of them bow their good evenings to me, but the theatrical flair has gone out of their movements. The bows are forced and nervous. Good.

I watch the two of them leave. I turn toward Mayor Barstow. "I lied," I announce. "I haven't quite finished my work. But I nearly have it all," I say. "Tomorrow, I want to see where the Vixa died. Then I'll be done."

It is a few minutes later when I retire to my own room. Officer Winters is waiting for me, sitting on the frowzy old hotel bed. His nervousness is plain to see. "I did what ya told me," he says. "Got the master key from Mayor Barstow and went into their rooms." He is holding a datapack as if it were a poisonous snake, and hands it over to me eagerly. "I plugged this datapack into their world guides, and downloaded copies of the guide to it."

"Good," I say, taking the datapack from him. "But these two, Hill and Megtish. They're good, really good. Do you think they'll be able to tell someone was in their rooms?"

"I dunno, ma'am. I ain't much for this spy stuff, ya know. Maybe they had some sensors or something."

There is no "maybe" about it. I would be astonished if Hill and Megtish did not have some sort of security monitoring system. The odds are good that one or both of them are watching playbacks of Winters stumbling in and out of their rooms right now. That suits me fine, as there is nothing they can do about it. I want them nervous. "I'm sure you did fine," I say. "But right now you'd better go before you're seen."

Winters is quite happy to comply, and it is barely an exaggeration to say he is out the door before I finish speaking. I sit down at the desk with the datapacks and plug them into my DV, let it work over the data for a minute, copying in

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the info from Hill's guide, copying and translating the Metrannan language info from Megtish's. I compare these to the world guide data copied into the Vixas's datapack.

World guides are just that, reference works covering a given planet, plugged into a simple, standardized, highly portable dataviewer. A traveler can buy a datapack for every world he visits, and always know the basics on geography, phone systems, visa requirements and so on.

Except, as I quickly confirm, these datapacks have been altered. I smile to myself and get ready for bed. It all fits.

I am asleep in bed that night when a thought wakes me up. Megtish and Hill are big spenders in this town, both of them clearly working to buy up some good will. That means they are being pretty free with their cash. There is yet another trap I can lay if I cut off their funds. Sleepily, blearily, I fumble for the lights and pull out my comm unit. I use my BSI overrides and order an immediate freeze on all their accounts, on and off planet. Then I set up an alert instruction, to advise me immediately of any activity in a certain corporate account.

Then I go back to sleep.

The next day, Barstow flies me to the death site in a specially built, heavily shielded hopper, a suborbital transport. There are three or four such shielded vehicles available for survey and scientific flights to the radiation zones. But even aboard the hopper, we must wear shieldsuits to keep out the radiation. They are big, awkward, uncomfortable things.

The journey to our landing site is depressing, a flight over the land of death and silence. It is difficult to look out the window, and impossible not to do so. We land and disembark without speaking much.

I step out of the lander, go down the ladder, and walk the dismal, hell-death lands in silence. Deseret has well earned its name. The land is dry, hard, barren, little more than blowing sand and sullen rock glowering in a sunlight that seems angry and hostile. We both move clumsily, carefully, in our shieldsuits. We are huge misshapen white forms, movmg through a land where life has been exiled, a land where death has made its home.

Here is where the two Vixa investigators met their doom. And there, a few hundred meters away, is the ship they left behind. It is too late even to think of recovering it. The radiation has seeped into it by now.

There are pieces of heavy equipment and stacks of construction material scattered about the landscape, likewise abandoned.

"We came in as fast as we could once we got the call for help," Barstow says. "One of the Vixa managed to use his personal comm unit to connect with their ship's radio. Over in there is where we found the bodies," Barstow says, pointing toward a long, low building that has the appearance of a hangar. It

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seems new and shipshape, out of place in this old land of deadly, shifting sands where all is long dead and decayed. There is a door at one side, and Barstow leads me in. We enter a vestibule, designed to keep the shifting sands from blowing inward. Barstow closes the outer door before opening the inner. We go inside.

Inside there is a spaceship. A small one, an antique, by the looks of it.

"This hangar is what they built about a year ago," Barstow says. "They used robots to do it all, of course. Had to scrap 'em afterwards. They had absorbed too much radiation and started to malfunction. Then they flew in this old refurbished sleepship. Never did understand why."

"Window-dressing," I say into my suit mike. "Activity for the sake of activity. So they could show receipts and business activity and claim to be working toward a full-fledged spaceport. So there were records to show to gullible investors." Except, of course, this window dressing was itself window dressing. By now I have no proof, and no doubt, that Megtish and/or Hill were behind CLE. They set up a con on their own company, selling the worthless spaceport to their partners, and then feigning ignorance of the transaction.

But this place was built not just for a land fraud, but for another, deadlier purpose. We poke around the hangar and the ship, but there is little that either can tell us. The ship is standing on her landing jacks, nose pointed toward the sealed launch port in the ceiling. I go aboard her while Barstow waits outside. He is understandably less than eager to enter this ghost ship.

I examine the controls. She is a human-built ship, in standby mode, ready to be powered up and flown on fairly short notice. She *is* old, old enough to have a cryogenics chamber. She is a sleepship, from the old days when starjumps took months or years instead of seconds. Beyond that, there is little that is remarkable. No jewels. No diamonds. No barrels of cash. What point in storing any such things here, where radiation would soon leach into their substance and make them deadly—and therefore worthless? For form's sake, I download the data in the ship's computer to my DV, but I know there will be nothing there. But even nothing can tell you something.

I come off the ship and look around the hangar. Near the doorway where we came in are two body outlines scanned down onto the dark, smooth surface of the hangar floor. This is where they died. I reflect on the terrifying agonies of the two who died here. *Their* race had powered down its last nuclear plant 20,000 years before. What experience could they have of nuclear radiation? Did they even know what hit them?

"Did they wear any shielding at all?" I ask.

"No ma'am. We found 'em out here just wearing street clothes,

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nothing else."

A horrible death. I turn and walk away, ostensibly to examine the rest of the place, but the hangar is otherwise barren. We go back outside without speaking. I look around the horrifying, desolate landscape. I know it is imaginary, know that I could not feel the radiation even if it penetrated the suits, but the mere sight of that irradiated landscape has made my skin itch and crawl. Still in silence, we head back to the hopper. It is time to leave this place.

It is on the flight back that I tell Barstow what I want done next. "There's something I need you to tell our two friends," I say. "Or rather, a story I want planted where they will hear it. Use someone in the town that is sure to spill it to them. Get it into the gossip mills so they're sure to hear it."

"That's easy to do," he says. "What's the story?"

"That I have sent word to Stanlar, instructing the police there to come here and make an arrest."

"Stanlar? Why there?"

"Because I have found the proof the Vixa cops left behind. Proof that either Hill, or Megtish, or both of them—you are not sure which—are guilty of killing that Stanlar Consortium on Vixa. Get the hint around that I'm not above manufacturing evidence, either." I don't want my plan to founder on the possibility that the killer could be *sure* there isn't any evidence.

Barstow looks at me through his shieldsuit helmet in fearful amazement. The draconian standards of Stanlar justice are legendary. With no real concept of the individual, the Stanlar regard a criminal about the same way we regard a wart or a grey hair or a hangnail—merely as something to be removed, pulled out, cut away. The penalty for littering—for any offense—is quite literally death. But vengeance is also a key concept of Stanlar law. For murder, the punishment is likewise death—but the slowest and most painful death possible.

"Is that true?" he asks, his voice echoing through my suit radio.

"Have I found proof that one or both of them killed the Stanlar Consort?" I ask. "Yes. Yes I have. I know who did it and how it was done." That's all lies, of course. Hunches, indications, hints. Those I have. But not proof. Barstow will do his job better if he believes.

"Plant that story," I say. "Then see to it you get sloppy about security at the spaceport. Make sure there are a few hoppers ready to go—but nothing that can reach orbit. Don't leave *all* of the hoppers open and ready, and don't prep the one closest to the entrance. We don't want to be too obvious. And have Officer Winters on watch tonight, out of sight, with a comm unit. He's not to interfere, but he is to report anything he sees."

"But—"

"But nothing. You and I are going to sit up tonight, Mister Mayor. We are going to sit up and see what we see."

* * *

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The mayor does his job well. By dinner time, the town is full of rumors. Hill and Megtish have heard them all. I see them at dinner, but I do not share this meal with them. The mayor and I dine in silence, at a table in the center of the room. Megtish and Hill each occupy their own tables, on opposite sides of the room. Doubtless neither wants to eat in the same room with us, but I have cut off their funds. Mayor Barstow took payment in advance, some days ago. With no money, there is no other place for them to eat but the Hotel.

Now each of them dines alone, staring at me. I feel twinges of guilt, and the flush of impending victory.

Alone. Harassed. Threatened. That is how I want them to feel.

Tonight one of them, maybe both, will panic.

The bar of the Hotel isn't too bad, as such places go. It is off in a quiet corner of the place, out of sight of the lobby and every place else, just the way a bar should be. The mayor is on duty behind the counter, and puts my tab on the house, which is awfully sporting of him, as the BSI is a bit stuffy about paying to get their agents drunk.

But I hold my liquor reasonably well, and as the night draws on, we switch to coffee anyway. If all goes well, I will need at least some of my wits about me later on.

We talk about everything except the case. About the mayor's garden, his grandchildren, about the office politics at BSI HQ, about the latest theories concerning the Cinderites and why they blew themselves up. He does not even ask why I told him to leave all the Hotel exits unlocked. But at last Barstow asks a direct question, and I have to answer.

"All right, Agent Wolfson. I've played nice long enough. What the hell is all this about?" he demands, leaning across the bar to refill my coffee.

I add just a splash of brandy from the bottle on the bar before I answer. "What are the symptoms of diphtheria?" I ask him.

He looks at me oddly, clearly convinced that I am not as sober as I pretend, and maybe he's right. "I haven't the faintest idea," he says.

"Neither have I," I say. "And yet it killed millions of people a few hundred years back. People were terrified of it. Do you take precautions against it here?"

Barstow snorts derisively. "No need to take 'em. Never had a case of it. Besides, I wouldn't even know what the symptoms were."

"So what would happen if there was a sudden outbreak?"

The mayor frowns. "We wouldn't recognize it. We wouldn't know what the symptoms were. It's all in the archives, I suppose. We could look up how to treat it—but we wouldn't even know what to look up. Maybe until it was too late."

"It would wipe you out, and you'd never know what hit you."

"Could be. So what's your point?"

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"The Metrannans—all the other starfaring races—gave up all forms of nuclear energy thousands of years ago. We're just starting to use spatial interstitial power systems. *They've* had 'em since forever. They don't know anything about radiation. We're the only race that has a recent memory of nuclear power and radiation. That's one reason we humans settled Cinder instead of someone else—we were the only race who knew how to deal with radiation. We fear it, know how it can kill, know how it can spread. Maybe some aliens know about it as an ancient, alien poison, but know about it in passing, on an academic level. But it is a primitive danger, long past. To them, radiation is harmless in the modern age, nothing to be afraid of. The same way we see a slight touch of diphtheria. I'm sure we could cure diphtheria—if we could recognize it in time and knew where to look up the treatment. They have not faced radiation poisoning in so long they believe it can no longer hurt them."

"And you think that's why the cops went out unprotected? But everyone who comes here gets warned. And it's in the guidebooks."

"The warnings are in English. Vixa and Metrannans are no good at languages. And besides, who reads guidebooks, even if they are in your own language? The Vixa cops were only on-planet a day or so before they went charging off. Did *they* have time to read up?"

I take a sip of coffee and go on in a grimmer tone. "And it doesn't do any good to read your world guide if your world guide has been altered, and the radiation warnings have been removed. I checked the Vixas's copy of the guide. Nothing about radiation. Nothing in Megtish's copy, either. All the non-English versions of the Cinder world guide are based on a master copy on file at Cinder Orbital. The system translates out from that version to whatever language is needed by whatever alien visitor passes by.

"Except there aren't that many alien visitors. In fact, I'll bet there haven't been any, besides Megtish and the Vixa, since a certain nameless representative of CLE came through to buy up the spaceport land a year ago. I think that rep was either Hill in disguise, or a human working for Hill or Megtish."

My comm unit goes off. I pull it out and look at the screen with a smile. "Some after-hours banking going on, I see. Mister Mayor, our friends have had time to slip past us by now. I think it is time that you locked up for the night. Lock up everything but the main lobby door. I think we should wait there." I pick up my drink and head for the lobby as the mayor, more mystified than ever, sets about his task. I turn the lights down low and sit on the least frowzy couch in the lobby, back to the wall, near the light switch, facing the main entrance. There is a banging and a thudding and a trudging as the mayor sees to all the locks.

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At last he comes back to me. "So now can you tell me what this is all about?" he asks.

"Remember, it's a tontine. Whoever dies last wins," I say. "But how to stay alive? After all, projected lifespan isn't much to go on with a murderer on the job. And a cryogenics system on a planet is clearly just an invitation to murder. Two of the tontine members checked out that way. Besides, even without fear of your colleagues, you would be there on ice, just waiting for someone like me to thaw you out and ask some rather sticky questions.

"So one of these two thought of a sleepship, a cryogenics tank aboard a spacecraft. What could be safer? Plot a secret course, keep the ship where no one—not your partner, not the cops—can find it. Set up a dummy company to build a spaceport in an out-of-the-way place, put the ship there, and then when the time is right, slip away. Vanish. Sleep well past the lifespan of your partner, then come back and collect."

"Wait a second," the mayor protests. "Suppose the other fellow decided to take cold sleep, too? Or just have you declared legally dead when you disappear?"

"Right on the first try," I say. "The whole plan is wholly unworkable as I have described it. But it just has to *seem* like it would work. Window dressing for the window dressing."

There is a rattle and a thud at the back door, but it is locked now.

The mayor and I sit in silence for an endless minute or two. At last there is a creak at the front door as it opens, and a stealthy figure comes through it, crossing the shadows toward the stairs.

I flick on the lights, and there is Hill. "The plan, however, makes for a first-rate trap," I say. "Which in this case is sprung on the person who set it."

My comm unit signals again and I slap it into speakerphone mode without taking my eyes off Hill. He stands there like a jacklighted deer. "Yes," I say to the phone.

"Ma'am, it's me, Bobby," the voice at the other end reports. "That Megtish fellow just grabbed a hopper and took off. Looked like he was heading for Deseret."

"Nice work, Bobby. Come back here and on your way see if you can raise Megtish and tell him that I have just received proof of Zebediah H. Hill's guilt in this matter. He can come back here and no harm will come to him. Make sure he knows that he is headed into terrible danger if he flies on."

"I doubt that he will believe you," Hill says quietly, speaking for the first time. "Megtish has grown extremely distrustful over the last few days, and rather jumpy. In part that is due to the circumstances, and in part because of the symptoms of advanced age in a Metrannan. I am afraid that the idea of facing the Stanlar authorities on his deathbed has rather turned his head. He will think that you are trying to lure him back here to his death."

"Meantime he is flying straight to

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the death trap you set up for him," I say.

"Wait a second," the mayor protests. "What proof have you got against *him?*" he asks, pointing at Hill. "It's the other fellow that tried to get away."

"Oh, they're both trying to run," I say. "Just by different routes. You'll recall I ordered all their accounts closed. That leaves a man intending to bribe his way off planet with precious few options. Hill here just played the only card he had left. He used an autoteller at the bank to draw every last dime out of a secret numbered account. The account belongs to Cinder Land Enterprises. The mysterious outfit that built that little radioactive spaceport out there. No one but the owner of CLE could have that account number."

I turn to Hill. "You had to come to Cinder, didn't you?" I ask. "To make it convincing, you had to act like *you* were trying to use the ship. Megtish had to think he had to rush to use it. He had to think you had set it up to escape from *him*. And you left that money in the CLE account because you knew you were coming back here. You wanted a secret cash supply in case something went wrong with the plan. Have I got that right?"

"I believe we are at that point in the proceedings where it would be wise for me not to answer any more of your questions," Hill said quietly.

"So we are," I say.

"Then answer mine, goddammit!" Mayor Barstow says. "What in the hell is going on?"

"It's perfectly simple," I say. "Well, perhaps not *simple*, but I nearly had it explained before Hill came in. One of these two was trying to trap the other into going aboard a ship that would kill whoever flew it. But you can't lay an obvious trap when your mark is a con artist. The trap has to be subtle, with some twists and turns in it. There has to be window dressing on it, something the mark will spot and brush aside, look past. That's why your window dressing needs window dressing. You need a con inside a con inside a con. Like a killer ship that appears to be a getaway ship, except the getaway ship is meant to look like just one more prop in a phony land deal you're using to con your company. But putting the props together was just the start. Whoever it was who put the ship out there had to come here and make it seem he was about to make a move for the ship, trick the other one into moving first.

"The Vixa cops showing up first and then dying was bad luck. The one running the con wanted to get here first, make a big show with the locals out of preparing to use the ship, then have the mark come in, see what was going on, and then steal the ship.

"They both rushed to Cinder as soon as Interworld's people spotted the strange expenditures and notified them. One of them was rushing here to make it look like he wanted to get on the sleepship, while the other one had read the Interworld

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reports, spotted the con job, but not the con within the con. That one truly believed in the sleepship as a getaway, and tried to get to it. That one, Megtish, was innocent in the deaths of the Vixa cops."

"If you had all this figured out, then why didn't you arrest Hill before?"

"Because I couldn't be sure I had it right. I had theories, indications, but not proof. I needed to get these two nervous, make them panic a bit, make their moves. I knew that Megtish was unlikely to know about the dangers of radiation poisoning—it's all diphtheria to him, after all. Still, it *could* have been Megtish.

"If Megtish didn't know about radiation, he would have to sabotage the ship, make sure it would kill Hill if he tried to use it. I couldn't find any evidence of tampering in the ship's data logs, which suggests it wasn't Megtish. On the other hand, there wasn't any evidence aboard the Consortium's ship, either.

"You, Hill, on the other hand, would have no need of sabotage, because you know that the radiation would kill. The ship has been sitting there long enough to be radioactive itself. Even if Megtish knows *something* about radiation, he would be unlikely to realize how it can spread and contaminate whatever it comes near. He doesn't know that ship is hot. He probably thinks that if he gets away from Deseret quickly he'll be safe. What would it be like to die of radiation poisoning in cold sleep?" I shudder at the thought. "I knew that whoever came through that door would be the one who built the spaceport, and therefore be the one who knew the sleepship was a death trap. Whereas the other one would simply know it was the only ship on the planet capable of reaching free space without refueling at Cinder Orbital."

There is the screech of brakes outside, and Officer Winters bursts in, breathless with excitement, and far more sober than I have seen him before.

"It's Megtish!" he half-shouts. "He says he won't come back. Says he knows it's a trap."

"Dammit! He'll fry inside of three days in that ship," Barstow said.

"If it lasts that long," Hill says with a certain sadness. "Heavy radiation has some unpleasant effects on electronics, and on the strength of certain materials used on that ship."

"Come on," Barstow says. "There's a high-power comm system on my jeep outside. Bobby —the hell with playing nice. You frisk Mister Hill for weapons and cash. I don't want him slipping off and buying some help from someone. Slap a stayclose bracelet on him. Set the range *tight*."

Night is dying, morning is near. The vigil at the jeep has gone on for some time as the hopper flies to Deseret. We have all taken turns bent over the microphone, begging, pleading with Megtish: telling him the ship is a death trap, that

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Hill is in custody, giving all the reasons to turn back. Even Hill lends his voice, telling Megtish that he has walked into a trap, but that it is all pointless now. He tells him that prison is better than death.

But Megtish does not believe us.

"Lies!" the voice of Megtish cries out from the speaker. "All lies from minute I land on this cursed planet. Death and lies! I will not spend my last days in prison! I land hopper, take sleepship, outlive you all and be rich!"

"Megtish, the game is up," Hill says again. "That ship is a trap. I know, I set it. But it's useless now. If you die it won't do me any good at all. It's all gone wrong. There's no point to it. Wolfson planted her stories to flush us out and it worked. Come back. Set down at Ashville Spaceport and live. You'll die in that ship."

Strange man, Hill. He tried to kill Megtish, and now he's trying to save him. I listen to his words as he speaks into the microphone, and I wonder if he is sincere, or if this is a performance for the benefit of a sentencing judge, or a parole board.

"Death and lies! The trap is on the ground, Hill. You bribed them to kill me, like I kill Stanlar. They shoot me if I land there. I go into cold sleep and outlive you! I be rich and you be dead!"

It is hopeless. Worse than hopeless after Megtish blurts out a confession to the Stanlar murder. No sane being would face the punishments of Stanlar justice if he could avoid it. I convinced Megtish that I *knew* he had done it. I have tricked him into confessing. Tricked him into flying off toward the sleepship, the death ship. Something twists at my heart.

Cinder Orbital is able to track the flight of the hopper. It is moving erratically. Is Megtish a bad pilot, or is he trying to avoid being tracked? Cinder Orbital reports the hopper has touched down near the sleepship. Then, so quickly that Megtish cannot have done a proper preflight check, Orbital reports the launch of the sleepship.

Once aboard the ship, Megtish does not even respond to our calls. Soon, the sleepship is a bright star slashing across the northern sky. "Megtish," I say into the mike as we watch the ship fly away. "You must land at once. You must. That is an old ship, and the radiation will have weakened—"

We are there, looking up, when the ship explodes. Somewhere in that tired old ship, a vital part has been rotted by the onslaught of heavy particle radiation.

When a spatial interstitial power unit big enough to lift a ship goes off, the results are spectacular. The light is blinding, thundering bright. Even after we recover our eyesight, there is a glowing, growing ball of light in the sky, painfully brilliant.

And there is nothing left to do but watch the light in the sky gutter down to nothing.

My traps have worked. I have caught one guilty party, and caused the death of another. But there is a deep, lump of pain at the base of my stomach.

* * *

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The last of the glowing cloud is fading away in the night sky as Zebediah H. Hill lights his cigarette with a negligent grace and exhales deeply. He exudes the relief of a man who is glad it is all over.

"I suppose I'm in for it now, aren't I?" he asks. "How will the charges read?"

"Eleven counts of capital murder in various jurisdictions. Two police officers and nine civilians."

"Ah, you did get it wrong then," he says coolly.

I look at him sharply. "How do you mean?" I ask.

"You are assuming I was party to the murders. It was Megtish who did the others in. You heard him confess to one of those murders." Hill shrugs. "Or maybe some of the others killed each other off. Good riddance to a bad lot in any event.

"I had no part in any death but Megtish's. Except for the police officers." What appears to be an expression of genuine contrition shows on his face, but Z.H. Hill is a splendid actor and I am not convinced. "The police were an accident. They merely stumbled into the trap I set for Megtish. And I suppose that I can thank you that he fell into the trap himself anyway, after the police had already died. Their deaths should have warned him, even if he did not know the planet was radioactive, or understand what that meant.

"But you pushed him over the edge with that story about the Stanlar and he panicked," Hill goes on. "You bear some complicity in all this, my dear. And you and Megtish's confession have saved me for that of our associates. He was greedy and ambitious. And he acted on his greed. So many of our colleagues had already fallen by the wayside I knew it could not be chance. I could either wait until he arranged an accident for me, or take steps to defend myself."

"You could have simply run," I say, "Waited until word of his death and then returned to claim the inheritance."

"No. Quite impossible. If I vanished completely, he would have declared me legally dead—Metrannan courts don't waste much time on delay in such matters. Understandable, given the brevity of their lives. He would have inherited instantly. If I had left any trace at all—which I would have needed to do if I were to come back and collect my inheritance, or even have access to my current wealth—then he could have tracked me down and killed me too. No, thank you. I considered it a much wiser policy to set a trap and let him venture into it. But I am guilty of no other blood."

"How can I believe that? You two set up the operation as a tontine," I remind him. "For you to profit from it required the death of your partners."

"Nonsense. You assume that it would be necessary for us to profit massively, all at once, and legally. None of those were the case. When we came to Interworld Transactions, we did so with every confidence trick we knew. The seeming value of our initial buy-in property

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was massively inflated. Just by taking our share of the profits, shares based on our wholly imaginary investment capital, we did very nicely. The tontine angle was there from the Stanlar courts, for which I thank you."

There is just enough truth in the accusation to upset me. It was the radiation-induced malfunction, not my plan, that did Megtish in. Still, I should have anticipated that the ship would not be reliable, that Megtish would be paranoid and refuse to turn back. Are my hands any cleaner if it is eventually ruled a death by misadventure? But I have caught his half-confession, and that is what should concern me now. "So, you admit that you planned the murder of Gadzang Megtish?" I ask.

"Oh, yes, of course." He drops the half-smoked cigarette on the ground and crushes it under his polished shoe. He offers me his arm, and I take it reflexively. There is a strange and disturbing thrill to the physical contact, the sensation of touching something controlled, powerful, and dangerous. He escorts me back toward the Hotel. "Or at least, I confess to *killing* him. It was not murder."

"That's an interesting distinction," I say as we walk along. "When is killing not murder?"

"My dear, that should be quite obvious to you. When it is self-defense. As you yourself must see, I had no motive for the murder. All I had to do was wait for Megtish to die. Whereas he, the shortest-lived of us all, had all the motive in the world, not only for my death, but to inveigle the longer-lived board members into signing us up. They saw themselves inheriting as soon as we died—a not far-off prospect as far as they were concerned. Meanwhile, Megtish and I were planning to rob them all blind, bit by bit. By selling the company a worthless spaceport, for example. No, far better to pocket our income and work quietly, carefully, slowly, to pilfer the assets. I think you will find that is exactly what we were doing. I would hardly bother to strip out assets from what I was expecting to gain legitimately."

"Unless you were anticipating this very conversation. Sooner or later, you as the survivor of the tontine were bound to attract police attention. Why not cover yourself against the charge of multiple murder with some smoke concerning lesser charges?"

He cocks his head and nods, left eyebrow raised. "An excellent point. Had I actually committed the murders, perhaps I would have done just that. I shall have to anticipate that in my defense. But it was Megtish who got greedy. He was getting old. Very old. He could not bear to let the others profit by his death, and could not bear to think that such a minor thing as his natural life span could get in the way of endless wealth. It drove him to distraction. He, not I, had the motive. Another point I shall have to remember."

We reach the Hotel, and enter the lobby. We stand there, for all the world like two old friends saying their good nights.

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"You do think ahead all the time," I say.

"I try to cover all the bases. Doing so is essential in my profession. Research of all the legal niceties, for example, is essential. Here is an interesting tidbit: Metrannan justice holds that the life of the young is worth more than the life of the old—understandable in their circumstances. The crime of murder on Metran is punishable by a span of hard labor equal to eight times the victim's projected remaining life span. That is almost always a life sentence to a Metrannan. But their idea of hard labor is not ours. Their civilization eliminated manual labor so long ago that almost any physical effort is regarded as 'hard.' My lawyers are good, and I expect the charge of Megtish's murder is the only one I am in danger of being forced to answer.

"According to the actuarial tables, Gadzang Megtish had less than three months to live. *If* I am convicted of his murder—*if*—I face a maximum sentence of twenty-four months gardening."

I feel a cold pit at the base of my stomach. "But you would still be denied any gain resulting from the crime. Surely Metrannan justice will see to that. They'll confiscate what you stood to inherit from him."

Hill smiles, and this time I am sure all the masks are gone. It is a smile of triumph, the smile of a card shark who knows his mark has taken the card he intended. "But there is not a scintilla of evidence connecting me with the other murders. Not surprising, as I did not commit them. Megtish did. If they find me guilty of Megtish's murder, I will be left to console myself with *half* the tontine's value. If I am found innocent—why then, of course, I will inherit all."

Suddenly I see it. I see everything, and I am horrified.

Hill had planned it all. He knew Megtish well enough to know the tontine would prey on Megtish's mind. He, Hill, had indeed set the tontine up as fraud, and had no intention of murdering his partners. There was no need to do so when Megtish's greed, ambition, and fear of death would drive him to murder. He let Megtish kill the others while he, Hill, behaved precisely as he would have otherwise, siphoning off what he could from the group's holdings. By the time he and Megtish were the only ones left, Megtish would be jumpy, watching for tricks and attacks. It was easy to draw a trap for his partner, one that had a built-in claim of self-defense.

Or have I read it all wrong again? Had he improvised, scrambled to save his life? Was it truly self-defense?

I look at Hill, and see that he has been watching me. He can tell what I have been thinking. "You will never know," he says. "Not for certain. That is the beauty of being known as a confidence man and a liar. I can tell you the truth a thousand times, and you will never believe me a thousand times over. No matter what I say, there will always be that nugget of doubt.

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"Allow yourself some consolation. Perhaps you will never know for certain if I am a murderer, but you will always be sure that Megtish was one. You have brought him to justice in the most final way possible. Think of it as half a loaf, far better than none." He stands, bows, and walks toward the stairs that lead to his room.

He pauses and turns toward me on the stairs. "Tell me," he asks, "do you think that half can ever be enough for you?"

I watch, staring, as he turns to go up the stairs. ■

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The Broken Land, Ian McDonald, Bantam, $22.50 hb (ISBN:0-553-08983-8), $11 pb (ISBN:0-553-37054-5), 322 pp.
A Million Open Doors, John Barnes, TOR, $19.95, 315 pp. (ISBN:0-312-85210-X).
Time, Like an Ever-Rolling Stream, Judith Moffett, St. Martin's, $21.95, 318 + xxxiv pp. (ISBN:0-312-08323-8).
Aristoi, Walter Jon Williams, TOR, $22.95, 447 pp. (ISBN:0-312-85172-3).
Why Do Birds, Damon Knight, TOR, $17.95, 268 pp. (ISBN:0-312-85174-X).
Sir Harold and the Gnome King, L. Sprague de Camp, Wildside Press (37 Fillmore Street, Newark, NJ 07105), $5.99, 71 pp. (ISBN: none).
Inside Science Fiction, James Gunn, Borgo Press (P. O. Box 2845, San Bernardino, CA 92406), 176 pp., $27 hb (ISBN:0-89370-312-5), $17 pb (ISBN:0-89370-412-1).
Science Fiction Comics, Mike Benton, Taylor Publishing Co. (1550 West Mockingbird Lane, Dallas, TX 75235), $24.95, 150 pp. (ISBN:0-87833-789-X).
Dr. Jane's Fossil Fever, Dr. Jane Robinson, THOR Records (PO Box 40312, Downey, CA 90239; also available from Unlikely Publications, PO Box 8542, Berkeley, CA 94707), 1990; $11.00 (cassette), $16.00 (compact disk) Reviewed by Stanley Schmidt.

I like Ian McDonald. After all, he lives in Belfast, Ireland. I live in Belfast, Maine. He's done some nice books, too. And now I learn that he, like me, likes to think about the future of biotechnology and the conflict that may arise between the proponents of biotech and mechtech.

On the other hand, where I have compared that conflict to the Nazi horror, he prefers to mix that with a touch of Viet Nam and the Middle East, Israelis and Palestinians, PLO and Hezbollah, ruins and refugee camps. The opposition of polytheistic Proclaimers and monotheistic Confessors. Or is it monotheistic Proclaimers and . . . ? Never mind. The specifics of doctrine are neither clear nor relevant, says McDonald. The point is human idiocy, and if people could only stop yakking at each other

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long enough to listen, they might be able to live at peace with each other.

The Broken Land begins in the town of Chepsenyt, where Mathembe Fileli is a young girl who does not talk. She communicates by gesture and stance and scrawls on paper, and that is enough for her to manage. As he follows her, McDonald shows us grandfather, his head severed at death for transplantation or implantation into the tree that keeps the ancestors alive (in a way). He shows us the trux that father grows in fifteen colors. He shows us tryx and gloglobes and shit beetles, and houses that can be frightened by loud noises, disassemble into insectoid units, and run away. He hints at religion and riotous youth, the Ghost Boys, and then he introduces the Empire and its mechanical technology in the form of a military squad issuing pointed warnings against joining or cooperating with the terrorist Warriors of Destiny.

Before long the ragtag survivors of a Warriors band turn up and are sheltered. The Empire returns, utterly destroys the town, and sends the townsfolk off down the road, homeless, stateless, meat for terrorists and militias. Mathembe's father is taken away. She and her mother and brother Hradu wind up in a big city where they scrape by until the civil war erupts in all its glory and puts Mathembe alone on a riverboat full of refugees.

The rest of the tale recounts Mathembe's struggle as she learns how to manage a mite more than mere survival, grows acquainted with the Dreaming, a sort of virtual reality where the dead ancestors reside, and quests through the camps for her family. When she finds them, she finds two very different answers to the problem of conflict—Kill! and Shut up and listen! It is no great surprise that she favors the latter.

McDonald's imagination is a marvelously intricate thing, and the world he paints feels quite real, alive, lived in. His book could be a documentary, a report on a Middle East or a Yugoslavia or a... that does not look much like ours but most certainly does live like ours.

Unfortunately, the answer he offers at the end seems far too easy, too simplistic, to justify all the effort he put into getting there. Perhaps as bad, the book's half dozen segments join together so awkwardly that the story lurches; perhaps they were written for separate magazine publication, though if that's the case, the book holds no clue. For all the richness of its texture, the book winds up feeling thin, anemic, not quite the novel it should have been.

As background for his latest novel, **A Million Open Doors**, John Barnes says that the human species will proliferate in the galaxy, settling a hundred worlds (or so) with splinter cultures derived from ethnicity or religion or myth. When instant travel via matter transmission or "springer" is invented, all these cultures are put in touch with each other. Naturally, the result is "contamination" and conflict and change.

One of Barnes's splinters is the world of Nou Occitan, whose culture

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has been modeled quite deliberately on the traditions or myths of Romance, full of posturing, dueling youths or Jovents and posturing, swooning ladies, with plenty of emphasis on honor. If it seems familiar, you're recalling Barnes's shorter "Canso de Fis de Jovent" from these pages a while ago. If it seems ridiculous, well, that is a good part of Barnes's point. He is showing us adolescents who refuse to grow up in a world whose wealth permits such folly. Yet, he says, growing up is something that comes to people willy nilly. Childish games grow stale and demand to be put behind.

For Giraut, this happens when his friend Aimeric is drafted to help his home culture, Caledon; a sternly religious, coldly rational lifeway that is the epitome of how adolescents must see adulthood, adapt to springer technology, open access to other cultures and wide commerce. Help is necessary because while the springer economy brings boom and immense prosperity, the initial impact is always depression, unemployment, and inflation. And that impact will be staggeringly worse in Caledon's tightly, artificially controlled economy, which forces people to work as a form of prayer, even when that means replacing a robot.

Giraut accompanies Aimeric and establishes a Nou Occitan academy to bring light, art, song, and joy to the repressed Caledonian heart. Not surprisingly, the academy proves a huge success with the young, survives the efforts of prune-faced elders to squash it, and contributes an invaluable yeast to the liberalization of Caledon. And in the end, well, adults have more fun than adolescents see. Decent adults do not make a fetish of rationality and necessity. There is a place for joy, trivia, the nonessential, and infinite variety free of culturally dictated Johnny-One-Note scripts.

This point is worth making. Some others, such as Barnes's claim that at least some women put up with being trivialized and even abused in order to get attention and other goodies, may or may not have some truth to them but will surely draw fire.

It would be nice to believe with Barnes that a joyous, liberal example could conquer the prune-faces, with or without a little help from the Secret Masters of Civilization. Alas, I cannot manage the trick. As McDonald showed more convincingly in his book, people are far too committed to their delusions and conditionings.

Judith Moffett's *Ragged World* earned high praise here and elsewhere with its portrait of marooned aliens, the Hefn, passing for hobgoblins, the people who met them, and the shipmates who finally returned for them and, offended by the mess humans had made of Earth, took over. The aliens were benign, and Earth needed help, but they were also bleeding heart nature freaks and animal lovers who forbade industry, energy obtained from oil, coal, or uranium, the use of animals in research, and human reproduction (with post-hypnotic sterilization). They favored small-is-beautiful, back-to-the-land lifestyles, and if such tactics could not

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support everyone on Earth, tough. There were too many of us around anyway.

There is no denying that our world needs help.

There is no denying that tactics as draconian as what the Hefn offer might work (though less industrialized populations can have horrendous environmental impacts too). The Hefn-favored lifestyle may even represent the only way our descendants will pass into the future, whether they choose to retreat to that lifestyle or rise to it after social-ecological collapse.

But there is also no denying the price. To live the way the Hefn and their Gafr masters would have us do must cost us our dreams of progress, increased prosperity, space, and more. It must turn us into peasants held down on the farm by paternalistic masters.

Judging from the sequel, **Time, Like an Ever-Rolling Stream,** this does not bother Moffett. A few years after the earlier book, Liam O'Hara and other teens are Apprentices in a Hefn school, being trained to operate the Hefn time-viewers and search for a time and place where and when humans lived in true harmony with their environment. The only girl Apprentice is fourteen-year-old Pam Pruitt, whose father is the librarian at a religious college on the Ohio River and makes insensitive comments about her body. She brings Liam home with her on vacation, and they visit Hurt Hollow, across the river in Kentucky. Here back-to-the-landers, rather like Scott and Helen Nearing, long ago established an idyllic homestead to which people now come in droves seeking some ineffable quality missing from their lives. They find the caretaker, Jesse, snakebit, get him to the hospital, and settle in to take care of Hurt Hollow. In due time the Hefn Humphrey arrives, and events conspire to develop the concept of holy ground, of a benign and worshipful relationship with nature. There is human outrage at the way the Hefn punish transgressors, a foam-at-the-mouth fundamentalist preacher, a lynch mob, incipient murder, a tornado, and—perhaps, just maybe—divine intervention.

In her frame tale, Moffett tells us of ley lines and a mathematics that might help people find sacred places like Hurt Hollow. The echoes are of those Asian astrologers and diviners who tell people where to put their houses, when to plant and marry, what color to paint a room. The story of Hurt Hollow itself is Pam's memoir, written years later when the events she recounts have led to a new religion, the Gaians, who take Hurt Hollow as a model of how life should be lived and go forth to preach and convert.

Is this still paternalism? Domination by the feudal monastery instead of the castle? Perhaps, but Moffett seems to approve, saying that even though the inspiration that led to hooking religion to the Hefnly mission may have been a con, it may have been a divinely inspired con, and God does work in strange ways.

This is one of those books that can make a rationalist materialist in-

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tensely uncomfortable. It denies the primacy of human freedom and independence in favor of divine guidance. We are children, it says, naughty children, and we must be told what to do.

Moffett's editor, Gordon Van Gelder, writes that she is planning a third novel in the series. It's possible that she will then turn the point I see her making on its head, but I don't think so. Moffett seems to display a deeply embedded religiosity, antirationalism, and even neophobia. She advocates a retreat to primitive living as the only solution worth pursuing. She turns her back on the notion that science and technology may hold solutions to the problems they have engendered. And that is a notion *Analog* readers must find far more congenial.

Walter Jon Williams's last novel was *Days of Atonement.* From it you might have expected his next to have something to do with religion and rigidity and stern, unforgiving discipline. You would even have been right, though not in the way you expected.

Long before the events of **Aristoi,** Earth was destroyed by runaway nanomachines. The few humans in space managed to survive and rebuild a technological civilization rooted in nanotechnology, life extension, genetic engineering, computers implanted in the brain, tachyon communications, and so on. The lords of humanity are the Aristoi, those few who can muster all the arts and technologies, liberate (with the aid of their internal computers, meditation, and pain) specialized subpersonalities or daimons, and build worlds. Their ethic is one of service to the people, the Demos, their goal the Demos's welfare and betterment, their life-style decadent and static, even rigid.

One of this civilization's mysteries is what happened to Captain Yuan, founder of the Aristoi system. Grown bored, perhaps, with the fruits of his achievements, he left to probe the galactic center. He never returned.

Now meet Gabriel, paragon of Aristo-craticism, deity of a cult founded by his mother. Another Aristo, Cressida, comes to him to share a puzzle. Saigo, a researcher in stellar and social evolution, had reported that the Gaal Cluster was hazardous because one of its stars was about to go nova. The Aristoi obligingly sealed it off. But Cressida, curious, had tapped the flow of data as it came in from the Cluster, and it did not agree with the data Saigo had filed in the Hyperlogos, the data bank into which Earth's moon had been converted, nor with any copy of Saigo's data stored where it could be reached through tachline communications systems. Only her isolated copy retained the truth: no nova, but terraformed planets peopled by humans afflicted by tyranny and disease and war. Saigo was playing god, tormenting the Demos whose welfare he should be protecting. Something must be done!

And then Cressida dies in a nanotech accident. Or was it an accident? Gabriel takes precautions, mounts an expedition to the Gaal Cluster, and finds the situation every bit as nasty

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as Cressida had thought. He lands in a nation the rough equivalent of sixteenth century Europe to investigate. His ship in space is destroyed. He tracks the villainy to its roots, and . . .

There are enough clues to what is going on to keep the reader from being totally surprised, but I still won't spell it out. What I will say is that here Williams is dealing with social rigidity, stasis, and considering the benefits of stirring the social pot to get things moving once more. How do you stir that pot? His villain wants to start new pots, to breed alternatives, and see where they go both while separate and on meeting. He is playing god in a very Old Testament, mean-spirited, meddling way. Gabriel is also playing god—he is named for an angel, there's that cult, he must be resurrected, and finally he must depart—but his style is that of mentor, guide, coach, inspiration. Of the two approaches, Williams says, Gabriel's is the more consistent with human freedom.

Aristoi is a fascinating exercise in high-tech allegory. Don't miss it.

One day in 2002, says Damon Knight in his new novel, **Why Do Birds,** a fellow named Ed Stone will be found in a Trenton, New Jersey, hotel room. He will be dressed appropriately for 1931, and he will have a pocketful of 1931 currency and a copy of a 1931 *Astounding.* When asked, he will say that he was kidnapped by aliens, kept in suspended animation, and finally returned to Earth to tell the world the planet would be destroyed in another dozen years or so. The human species will be saved only if it builds a cube a mile on a side and stashes everyone inside in suspended animation. The aliens will then take the cube to another world.

The local authorities quite naturally conclude the guy's a nut and remand him to the local loony bin. But Ed has a ring whose touch makes people love and believe him. He shakes hands with the shrink, and soon he is on his way.

Where to? Well, a story like his is a hard sell. He has to shake a lot of hands, and since the effect seems to wear off, he has to shake them again, and again, all over the world. Exhaustion seems one likely destination. So does failure, for when he reads every twelfth letter of that old *Astounding* he discovers hints of a conspiracy against him, there are vested interests who don't want to believe his story no matter what evidence he can adduce, and some people would rather die at home. Then too, someone finds a woman whose runaway husband just might be Ed Stone; he thought the world was destroying itself with overpopulation and pollution, and a scam like this might just be right up his alley.

But the Cube does get built. It gets filled, mostly. And when *der Tag* arrives . . . Knight calls this "a comic novel of the destruction of the human race," says his editor. I think its comic moments are too few to raise it above the level of a minor sit-com, but I still won't reveal what Knight took some pains to keep uncertain until the very end.

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When I went to Readercon (in Worcester, MA) last July 11, I spent a few minutes talking to John Betancourt of Wildside Press and came away with a copy of L. Sprague de Camp's latest entry in the famous saga of Harold Shea, the incomplete enchanter who rode his syllogismobile from mythworld to mythworld, **Sir Harold and the Gnome King.** Harold is married now, and the baby is due soon. But his mentor, Walter Bayard, is lost. Harold would like to rescue the man, but he knows of only one way to do it: Visit the land of Oz and borrow the Gnome King's belt, which permits teleportation. Unfortunately, when he gets to Oz, he finds Dorothy and other characters all grown up, the prickly Gnome King is a cactus, and the belt isn't for loaning unless Harold can rescue the hostage prince from the usurper who now rules the Gnome kingdom. But all goes well, and quite soon Harold is off home once more.

It doesn't have the magic of the original, but it's cute enough to pass as a tidbit for the fans.

Perhaps more interesting is Wildside's new line of "minibacks," tiny (5.5" × 4.25"; 64 pages) booklets containing the rough equivalent of four short stories. Number zero, given free to series subscribers, is **Performance Art**; it contains four of Betancourt's own stories. Number one will be Fritz Leiber's **Kreativity for Kats,** with three uncollected cat stories. After that, Betancourt has planned volumes by Martha Soukup, Karl Edward Wagner, and Steve Rasnic Tem. Prices? $2.29 per paperback, $13.99 per trade hardcover, $22.50 per limited edition hardcover; $19.95, $79.95, and $125 for the corresponding eight-issue subscriptions. Schedule? Betancourt plans to release two minibacks every other month.

When I was young, one of my favorite SF novels was *Star Bridge*, by James Gunn and Jack Williamson. Later I found other Gunn novels and the *Alternate Worlds* history of SF and learned that Gunn was a scholar of SF and among those who first put SF in the English Department curriculum. I have enjoyed his work, both fiction and nonfiction, so much that when the library of his school, the University of Kansas, asked for materials I was instantly prejudiced in its favor.

All that being so, how could I possibly ignore **Inside Science Fiction** when it appeared in my mailbox? This is the first book to collect Gunn's thoughtful and accessible essays on the history and nature of SF, the relationship of SF to the educational and scholarly establishment, SF on film and TV (given point by Gunn's own experiences when *The Immortals* became a TV special and short-lived series), and the connection of SF to the space program, the psychology of modern times, and more. The oldest essay dates to 1971, the most recent to 1989. All are worth reading despite a modicum of repetition, for even Gunn's oldest insights have a way of remaining pertinent. All are also very readable.

Whether you buy this one or not, be sure to call it to the attention of

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your favorite librarian.

Mike Benton's **Science Fiction Comics** is the third in a series of "illustrated histories" that includes volumes on horror and superhero comics. Earlier, he did *The Comic Book in America.* That's enough to make us believe that Benton knows his comics and warrants his "well-known authority on comic book collecting" billing. And when the jacket flap says that he "is a lifelong believer in the 'zen' of comics," we get a hint of the way he regards his field. That is, he sees comics pretty clearly for what they are, admits that one really must suspend one's higher critical faculties to enjoy them properly, and loves them anyway.

Or, in his own words: "The science fiction in comic books is. . . of the most elemental and primary sort. Characters are often caricatures, plots rely on formula, and stories are action driven, with little room for reflection or observation. And therein lies the charm, the appeal, and the strength of the science fiction comic book.

"Straightforward and simple-minded, a science fiction comic book story taps into the primal dream state with its exaggerations, archetypes, and colorful images. . . ." (p. 5).

Not to mention hordes of villains with names like Ming, Auro, Menthor, Zorg, and Jark; heroes such as Buck (Rogers, of course), Flash, Tom Corbett, Spacehawk, Adam Strange, and Lars of Mars; yucko-supremo drool-and-fangs monsters; and bevies of scantily clad curvaceous lasses, including a few in those famous brass brassieres. It all reemerges from the mists of memory—and beyond, all the way back to the dawn of SF—in this survey of a side of SF many lovers of the printed word (accompanied by at most one or two tasteful black-and-white drawings) cannot enjoy without looking over their shoulder to be sure they're alone.

The book is logically organized, beginning with an overview of the field followed by discussions of its Buck Rogers and Flash Gordon roots, the comics of the '30s and '40s, the innovative, widely imitated EC comics, the '50s, the '60s, TV spinoffs, movie spinoffs, and a comprehensive checklist for collectors. And it contains plenty of reproductions of garish covers and faded interior pages.

The book seems aimed at the collectors market. But it's also for all who can see the accumulation of pop culture as history, for those who wish to revive old memories, for those who need reminding that SF is more than print and movie and TV.

The first two issues of **Futures Past** have reached me from editor Jim Emerson ($5 per six-issue year [$27 outside U.S.], from Futures Past, P. O. Box 610, Convoy, OH 45832), together with a "Publicity? Please?" note.

Glad to help, Jim. The magazine is a historical approach to the "sense of wonder." Each issue takes a year in the history of SF for its focus, reviews the year's events, including books and films, provides an art gallery of vintage interior illos, and tosses in a couple of articles, mostly reprints and excerpts. Issue #1, for 1926, has arti-

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cles on Hugo Gernsback, *Amazing* (from Mike Ashley's and Robert A. W. Lowndes's forthcoming *The Gernsback Years*), and Curt Siodmak, and Frederik Pohl's autobiographical "Astounding Story" (from *American Heritage*, 1989). Issue #2, for 1927, continues the Ashley-Lowndes excerpt, adds material on Fritz Lang, and excerpts "The Golden Age of SF Is Twelve" from David Hartwell's *Age of Wonders*. In both issues, the art gallery showcases the work of Frank R. Paul. There are also bibliographies, and subscribers have access to the Science Fiction Resources Network, a database for the field.

Just the thing for fans with a historical interest, and that database sounds like just the thing for folks with questions of the "Who wrote X?" and "When was X published?" sort. Of course, you do have to be a subscriber to get an answer.

Some time ago I mentioned here that some filk music (that peculiar and distinctive folk music of the science fiction subculture) had begun to be available commercially on audio cassettes. My mail later brought a review copy of what was heralded as the first filk CD, *Dr. Jane's Fossil Fever*. I did nothing with it at the time because I had not yet acquired a CD player or heard of Dr. Jane. However, when I did get a player, *Fossil Fever* (being the only CD I then owned) was what I used to try it out—and what a delightful surprise it was!

It's an exceptionally ambitious effort, featuring a wide range of musical styles (all peculiarly well suited to their lyrics), a large and diverse instrumental backup group, and a complexity of ensemble seldom feasible in a convention filk room. Dr. Jane wrote all the songs and does the lead vocals, with Cynthia McQuillin as second lead. I'm sorry space doesn't permit crediting everybody involved; suffice it to say that all the performances are professionally polished and lots of fun.

Principal credit, of course, goes to Dr. Jane, whose songs are uncommonly clever in both music and verse. All draw on her background in paleontology. Some, such as "Movin' the Bones," and "That Everlastin' Outcrop in the Sky," deal with the profession itself in a way whose satire will be especially appreciated by anyone who's ever seen the world behind the scenes of a museum. Most, though, feature the prehistoric critters themselves as viewpoint characters. If you're not sure this sounds like your cup of tea, I'd suggest you just sample a couple of cuts—say, "Tyrannosaur's Lullaby," with its delicious juxtaposition of gentle melody and bloodcurdling lyrics, and "The Great Cretaceous Hadrosaur Headbone Horn Quartet." After that, I suspect, you'll be ready to settle back and enjoy the whole thing. ■

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BRASS TACKS

Dear Dr. Schmidt:

I enjoyed Roger MacBride Allen's *The Modular Man* 2/92-5/92). But I am disappointed that no one in the story seems aware of an important principle.

To summarize: Entwhistle recoils in horror from a future in which the rich save themselves from time with fantastically expensive prostheses (and continue to enrich themselves forever, at the presumed expense of the poor), while the poor die as always. Crandall proposes essentially the same solution as in Joe Haldeman's *The Long Habit of Living:* by law, rejuvenation costs all you have.

I can't see that the Crandall plan would satisfy Entwhistle; it opens no doors for the poor, and it does nothing to keep the talented from accumulating wealth throughout their eternal youth.

But more important is this: *Technology is always cheaper the second time.* We see this at every turn.

Twenty years ago, "electronic slide rules" cost $400; five years later they were $20. Five years after that they were passed out free as advertising gimmicks. More recently, I saw the price of those pretty pink-and-purple plasma spheres drop by a factor of ten or twenty within one year.

By denying immortality to the rich, Entwhistle would shut off the research and refinement that could ultimately make immortality as universal as automobiles, to take a more mundane example. Crandall's plan, by blunting price competition (if rejuvenation costs everything, why bother trying to make it cheaper?), would merely delay that happy day.

Is Allen's story perhaps a parody of public health-care policy?

ANTON SHERWOOD
San Francisco, CA

Dear Editor:

I have read with interest the first three installments of Roger MacBride Allen's *The Modular Man.* The moral issues it raises are of interest and predictive of future ethical dilemmas. However, I wish to take issue with the author's perspective on disability. His view of the future is that people with disabilities would utilize technology to isolate themselves rather than to facilitate their ability to interact.

Thirty years ago I experienced quadriplegia due to a spinal cord injury. The prevailing attitude was that persons with severe disabilities should be institutionalized and withdraw from society. Fortunately, with

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the support of my family and friends I did not yield to the medical advice and I re-entered the community. Since then this attitude has been successfully challenged by many disabled people and our culture has become more receptive to the integration of people with disabilities.

As an ardent fan of science fiction I have noted that the best works in this genre project a future based on insight into current societal trends. The key premise of *The Modular Man* is the reluctance, indeed aversion, of a central character to interact with society except through a surrogate android. Based on the increase of people with disabilities who are actively involved in their communities I can assert with confidence that Mr. Allen's premise is flawed.

Having, over the past 30 years, used the technology available to facilitate my serving as an administrator, a counselor and a consultant, I look forward to new innovations. The idea that future innovations would serve to isolate me rather than enhance my ability to move within my community is an affront and lacks plausibility.

THOMAS J. CONNORS PH.D.
North Branford, CT

It seems to me that withdrawing or isolating herself was the very opposite of what Suzanne was doing with the remote technology! I think she would see the remote as a means of interacting much more fully than she could without it. I further suspect she would see the remote as merely an accessory to help her do that, and might well be surprised at the emphasis you place on the geographic location of her biological body. As you have noted, attitudes have already evolved quite a bit, and will no doubt continue to do so!

Dear *Analog*:

Members of the vivisection industry are struggling to maintain the illusion that animal experiments are necessary to protect patients and consumers, but animal tests don't predict some of the frightening side-effects that users of drugs and cosmetics experience ("Accept No Substitutes," June 1992 editorial). In 1989, hospital emergency rooms treated 35,000 individuals with product-related injuries—those caused by cosmetics, household cleansers, and other items that had been "safety" tested on animals. And, as a result of taking animal-tested medications, countless others have suffered every kind of side-effect from dizziness to deafness, and even death.

Indeed, we might all be better off had experimenters relied less on animal tests and more on clinical and epidemiological studies. Animal experiments have continued for two centuries, yet we still have no *cure* for cancer, diabetes, cystic fibrosis, etc. Researchers spend billions of tax dollars a year artificially afflicting other-than-human animals instead of studying the spontaneous development of disease in humans.

Nor does your editorial adequately address the ethical concerns of using animals in experiments for humans' health or "education." Estimates vary, but between 20 million and 100 mil-

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lion animals are killed in US laboratories each year. They are subjected to burning, blinding, starvation, injection of cancer cells, and worse. In most cases, they live in cages either in isolation or in overcrowded conditions.

Animals used in toxicology tests suffer a range of symptoms including convulsions, vomiting, diarrhea, bleeding from the nose or mouth, and intense pain. Animal tests are outdated and unreliable; alternative methods, such as cell cultures or product trials by human volunteers, give a more objective evaluation of a substance. More than 400 companies now make safe, high-quality products without testing them on animals.

Another 5 to 6 million animal corpses are used in high school dissections. An investigation into the practices of the world's largest biological supply company revealed, among other atrocities, that cats and rats were being embalmed alive, and that rabbits were drowned in water-filled barrels. Students don't learn about their connections with the rest of the animal kingdom by looking at the innards of a dead animal, but by observing live animals in their habitat.

When we understand that animals experience, pain, hunger, thirst, fear, and even hopelessness much as humans do, we realize that we can no longer stand by while animal experiments continue.

CHRISTINE JACKSON
PETA—People for the
Ethical Treatment of Animals
Washington, D.C.

The editorial didn't address the ethical concerns at all, because they're a separate subject and not the one I was considering that month. My entire concern there (which, interestingly, your letter does not address) was the fallacy of the specific argument that computer simulations can completely replace animal experiments. Neither *animal tests nor simulations can completely replace* human *tests—and few humans will volunteer for the earliest animal tests, but you need to understand that that will mean doing without some of the knowledge that could be gained from them. The argument that computer simulations can do everything animal tests can do simply won't wash.*

And while observing live animals is important, it provides no familiarity with their inner structure and workings—so that's not a substitute, either.

Dear Stan,

In reading your article about simulations, you remark that computer-based simulations of wind-tunnels are adequate because the computations are well understood. Sorry; nonlinear, turbulent, and chaotic effects are not well understood, and we don't have adequate mathematical simulations. If the company is Boeing, simulating their latest 747, they can afford months or years of supercomputer time with very accurate models. But smaller companies with smaller simulations can't afford the time or the computer costs to do models with the same accuracy of simulation.

But even real wind tunnels them-

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selves are not adequate. The building in Boston (was it the John Hancock building?) that kept popping its windows was simulated in an actual wind tunnel, not a computer simulation. Because of the expense, the wind effects were simulated at 10 degree angles. Guess what... the failure mode that caused sufficient vacuum to pop the windows happened at 35 degrees! "Of course," say the critics, "it should have been simulated on the computer, where it would have been cheaper." Right. Have you priced out Cray time recently? Complete models are still not possible, so we compromise something. More accurate models take a lot of computation, which take either a lot of time (on small machines) or a lot of money (on supercomputers) or a whole lot of both. So, a really accurate model would take too long to compute at, say, 1 degree intervals, so either the accuracy of the model or the intervals of computation are compromised. And of course, it probably models the building cross-section as a rectangle, which it isn't. Gaps, edges, window discontinuities, all matter.

The ILLIAC-IV, the largest supercomputer of its era, had hundreds of dummy integrated circuit packages on each board, whose sole purpose was to guarantee laminar flow of the cooling air. Turbulence caused by the gaps at the unused sockets resulted in failures in uniform airflow that resulted in hot spots; chips would overheat and self-destruct. If this had been modelled, it is possible that the assumption of laminar flow would have been built into the program, and it was a false assumption.

So the very best model of turbulence, chaotic effects, etc. may have no relevance if the basic assumption, e.g., that the building is a rectangle, is faulty.

And, as you so correctly point out, biological systems are so complex that we cannot accurately simulate them except at the most trivial levels. I, for one, would never accept a drug that was "simulated thoroughly" and "found effective with no side-effects under six independent computer models." My Ph.D. is in computer science. I *know* the limitations of the technology.

(I should point out that I am alive today because of animal testing; the mechanical heart valve which replaced the defective valve I was born with was extensively tested via animal surgery. It is also possible that my surgeon practiced on animals such as dogs or pigs before doing surgery on humans. Therefore, I am not an unbiased opinion.)

DR. JOSEPH NEWCOMER

Pittsburgh, PA

Dear Dr. Schmidt,

I have just finished reading "Blood Relations," and it has driven me to my word processor. First though, I must compliment you on both the quality and quantity of material that you publish, and I fully intend to renew my subscription when the time comes. Secondly, I would like to say that Ms. Ecklar is quite the up and coming scholar, and I wish her much luck and joy in pursuit of her newly chosen

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profession. I have had the opportunity and pleasure of hearing her sing via her *Divine Intervention* tape. Not withstanding her vocal talents, I look forward to her future foray's into the printed medium.

I have found "Blood Relations" enjoyable on more than one level. The first and foremost is the pure readability and lucidity with which she tells her tale. I particularly enjoyed her characters—specifically that of Rahel. At first, while I was enjoying the story, my underlying desire was to know why Rahel would be so antisocial. And, being of the scientific bent while reading the erstwhile "Speculative Literature," I assumed that Ms. Ecklar would include a complete and perhaps clinical analysis of Rahel's motivations. Alas, much to my initial chagrin, and pleasure, she did not succumb to this temptation, and left her character enigmatic, if not archetypal, in this sense. I realized, belatedly, that this forced me to take a step back and view my reactions to Rahel from a distance, and perhaps analyze and define myself in the process, rather than just being gratuitously supplied with a neat package of sociology to be digested with a certain, if transitory, relish. It caused me to question my own assumptions of Rahel's behavior and perhaps, no actually, I am better for it.

I wish to thank both Ms. Ecklar for writing the story, and you, Mr. Schmidt, for seeing its underlying emotive qualities and publishing it.

MICHAEL C. ROBERT

Allston, MA

Dear Dr. Schmidt;

With regard to "*Analog*'s New Home" (6/'92, p. 75), I felt provoked to write. In brief, corporate shuffles generally make me nervous since I have witnessed every principle, value, and desirable quality readily sacrificed to the short-term expedience and greed of a few. We readers have no way, as yet, to judge the stated intentions or implications of the Davis to BDD transfer. However, the nuclear violence of R. L. Forward's "Self-Limiting," succinctly captured my hostility towards that human weakness that we generally hide behind the arrogant hollow word: economics. This hyperbolic example is presented to contrast the warmth and value I place on the continued function of *Analog* in status quo. That status quo is perceived as a vehicle for providing life-saving escapism, creative stimulation and provocation, even being technically informative.

Beginning at age 14 (I'm now 45), *Analog* has been the single most persistent and consistent element in a vast and eclectic diet of SF, fantasy, and smaller bites of other fiction genres that I've read and collected. Except for some instability gaps during college and the army, I still have most of the *Analog* copies bought or subscribed to. Both as a student and teacher, I have found examples from *Analog* worth bringing to class, and as a research ecologist and political activist I have reinforced my stance by handing over selected *Analog* photocopies. As a story-telling ex-Texan, I appreciate the greater final impact

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when a moral principle, or human trait is creatively elaborated and embroidered rather than flatly stated. I am addicted to the "potato chip" format because I can manufacture 10-30 minute reading excuses more easily than the multi-hour chunks to digest a full novel (which I use sporadically to keep my diet balanced). So Dr. Schmidt, counsel your publishers (present and future) to biological conservatism (with occasional trial mutations). It has great survival value!

DANNY L. RAMBO

1209 Mill St.
Springfield, OR 97477

Dear Stan,

Two matters concerning the July 1992 issue, which I seem to have misplaced.

When the only stories published about Christians are of the fanatics who are trying to force everybody to live and believe their way, you are publishing only stories that cut down and make fun of Christians. I realize that this is the fault of the writers that only write interesting stories about the fanatics, but the facts remain that you and *Analog* are publishing only stories that cut down Christianity and from the force of your reply you realize this, at least subconsciously.

In the article about computer nets allowing the public greater access to the news and not allowing the networks to dictate what news we get and how it is slanted, the writer forgets two things. The bulletin boards are only available to those people that have a computer with a modem, and can afford to call into the bulletin boards. As the AI filters mentioned grow more sophisticated, we will no longer have everybody receiving just the side of the issues that the networks want us to receive (which is good) but the people who use the filters will receive only the side of the issues that the writers of the filters want us to see, and will be back in the same boat with different editors. Only the people who consciously try to get both sides will be sure of getting all of the issues; these same people can do this now, at least in most cases, by looking for other sources than the networks. Although he is correct in saying that the differing opinion will be easier to find, since some of the libraries are taking the position that only politically correct publications are to be carried.

RICHARD T. KETCHUM

Kansas City, MO

We don't publish only stories that cut down and make fun of Christians. To cite just the first few counterexamples that come to mind, you might take a look at James White's "Sanctuary," Arlan Andrews's "Epiphany," Timothy Zahn's "Soulminder" series, G. David Nordley's "In HIS Image," and Stephen L. Burns's "Leap."

I must also remind you that criticism of a particular subset of Christians for reasons other than their Christianity does not equate to criticism of Christianity. ■

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UPCOMING EVENTS Anthony Lewis

12-14 February
CONTINUITY 93 (Birmingham area SF conference) at Parliament House, Birmingham, Ala. Guest of Honor—Joe Haldeman. Registration—$15 until 8 November, more thereafter. Info: Continuity, 620 80th Place South, Birmingham AL 35206 (include SASE). (205) 836-6460.

19-21 February
BOSKONE 30 (New England area SF conference) at Sheraton Tara, Framingham, Mass. Guest of Honor—Joe Haldeman; Official Artist—Tom Kidd; Special Guest—Beth Meacham. Registration—$29 until 17 Jan, $40 at the door. Info: Boskone 30, Box 809, Framingham MA 01701-0203. (617) 625-2311.

4-6 March
WORLD HORROR CONVENTION 3 at Sheraton Hotel, Stamford, Conn. Writer Guests of Honor—Peter Straub, Les Daniels; Artist Guests of Honor—J. K. Potter, Stephen Gervais; MC—Stanley Wiater. Limited to 1000. Registration—$75 attending, $25 supporting. Info: World Horror Convention, Box 191, Andover CT 06232.

19-21 March
LUNACON '93 (New York area SF conference) at Rye Town Hilton, Rye Brook, N.Y. Guest of Honor—Orson Scott Card; Artist Guest of Honor—Barclay Shaw; Publishing Guest of Honor—Richard Curtis. Info: Lunacon 93, Box 338, New York NY 10150-0338.

2-6 September
CONFRANCISCO (51st World Science Fiction Convention) at Parc 55, ANA Hotels, Moskone Centre, San Francisco, Calif. Guest of Honor—Larry Niven; Artist Guest of Honor—Alicia Austin; Fan Guests of Honor—Tom Digby and jan howard finder; MC—Guy Gavriel Kay. Registration—$85 adult/$30 child until 30 September 1992; Supporting—$25. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: 712 Bancroft Rd, #1993, Walnut Creek CA 94598. (510) 945-1993. CompuServe 72377,3623.

You can send me e-mail about your convention—A.LEWIS20 on the GEnie™ network. ■

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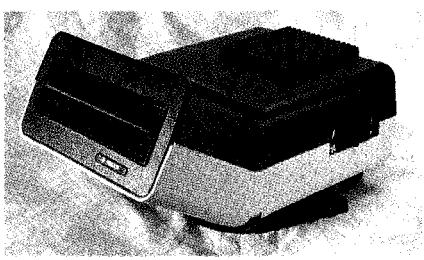

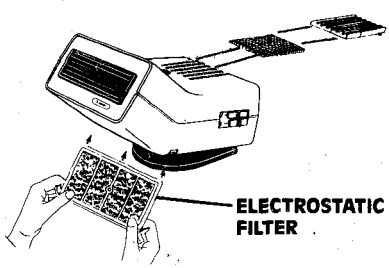

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